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PROMOTION OF MEDICINE AND PHARMACY[1]

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ONE of the duties of the president of this convention, as stated in the by-laws, is the presentation of an address "embodying such subjects as may seem to him suitable to the occasion."

Since many of those present are attending a meeting of the convention for the first time, it may be well to speak briefly of the purposes and history of this organization. It was founded in 1820 and has been in continuous existence ever since; the first sessions were held in the Senate Chamber of the Capitol. It is one of the oldest organizations in the United States, antedating by many years the American Medical Association, the American Pharmaceutical Association, the National Academy of Sciences, etc. It was founded by physicians; perhaps it would be more accurate to say that it was founded by a single physician, Lyman Spalding. Spalding was a man of rare vision; he was a pioneer in medical education and sanitation; he had an important part in the introduction of vaccination into the United States. His most important service, however, was the founding of the U. S. Pharmacopoeia, which is the oldest national pharmacopoeia of a modern type in the world. The U. S. P. was the first pharmacopoeia to adopt the recommendations of the Brussels Conference for the Unification of Potent Medicaments; it thus became the first national pharmacopoeia with an international character. It has also been translated into Chinese and Spanish; it is the official pharmacopoeia of Cuba.

This convention, which is incorporated under the laws of the District of Columbia, is different from most associations; the members are not here for any personal gain; all their activities are in the interest of the health of the people of the United States.

[1] Presidential address delivered at the 1930 U. S. Pharmacopoeial Convention, on Tuesday, May 13, in Washington, D. C.

The articles of incorporation state that the objects and business of this association are the promotion of medicine and pharmacy by selecting such materials as may be properly used as medicines and drugs, establishing formulas for their preparation and standards for identity, strength and purity.

Thus, provision for the selection of materials which may properly be used as medicines is the first duty of the convention.

So perhaps our function may be compared to that of those who are behind the lines of combatant troops: to select, standardize, properly label and pass forward the munitions which the actual fighters need. How important is the correct labeling of a drug may be indicated by the fact that one drug (epinephrin) was passed forward under thirty-five different names. The physician is constantly confronted with so many difficult problems that it is unfair both to him and the patient for such additional confusing factors to be introduced.

I think we must admit that those whose lives are spent in constant contact with the sick are in a better position to judge of what is and what is not useful than are those who can get such information only by gossip and hearsay. Hence, it has usually been the custom to place the major portion of the responsibility of determining what medicinal agents shall be admitted to the Pharmacopoeia upon the medical members of the convention, while much of the remainder of the revision work has been carried out by the pharmacists and chemists, who were invited by the physicians to join this organization in 1850.

This general principle was enunciated in 1820 by the founders of the U. S. P. in the following words: "It is the object of a pharmacopoeia to select from among substances which possess medicinal power, those, the utility of which is most fully established and best understood; and to form from them preparations and compositions, in which their powers may be exerted to the greatest advantage." Similar views had been expressed in the Pharmacopoeia of the Massachusetts Medical Society (1808)—the first civilian pharmacopoeia prepared in the United States, and which served as a model for the U. S. Pharmacopoeia. The authors of this work also had decided views as to the responsibilities of the two professions concerned with the preparation of a pharmacopoeia. They stated: "As it is the business of the physician to prescribe and of the apothecary to prepare medicines, the physicians as a body ought to point out those articles of medicine which they shall ordinarily employ, and the standard preparations of them." In later revisions reference was made to the "wants of the medical profession," the undesirability of "pandering to fashion," etc.

These principles were reaffirmed by the last convention when it stated that the object of the Pharmacopoeia is to provide standards for drugs and medicines of therapeutic usefulness or pharmaceutical necessity. In carrying out this program, fifteen subcommittees were elected; eleven of these consisted largely of pharmacists and chemists, whereas in four, medical representatives predominated. In the committee on scope (admissions and deletions) there were sixteen representatives of medicine and five of pharmacy.

This principle of "therapeutic usefulness or pharmaceutical necessity" has prevailed during much of the hundred and ten years of the existence of the Pharmacopoeia, but for a comparatively brief period "used" rather than "usefulness" seems to have governed the admissions. This led an eminent physician, for twenty years president of the convention, to state that there were preparations in the U. S. P. no more active or more useful than brick dust, and that brick dust would go into the Pharmacopoeia if there were a demand for it.

Such a view of the scope of the Pharmacopoeia has not been usual; it is inconsistent with the very purpose of the work as stated in the articles of incorporation; certainly medicine and pharmacy would not be promoted by the inclusion of worthless drugs. Physicians have frequently been thought to be rather indifferent to the Pharmacopoeia and perhaps for two or three decades they were: a physician engaged in a life-and-death struggle does not want his armamentarium cluttered up with brick dust and it has always been and always will be useless to expect his support for a work of that character.

That revision committees recognized the fallacy of basing admissions upon use is shown by the fact that, in the course of three decades, no fewer than 573 articles were dismissed from the U. S. P.; although the suggestions as to the preparations to be omitted originated for the most part with the physicians, the representatives of pharmacy, who outnumbered the physicians two to one, gladly acquiesced.

May not this return to the ideals of the fathers of the Pharmacopoeia be another recognition of how clearly the men of that day saw great general principles? Would not the founders of the Pharmacopoeia have been as surprised at some of the developments in regard to this work as the authors of the Constitution of the United States would have been at some of the amendments which have been added?

There never has been a time when there were not drugs in rather extensive use which were soon forgotten: the authors of the Pharmacopoeia of 1820 evidently had this in mind when they stated that, of the substances which possess medicinal value, only those

the utility of which is best established should be admitted to the Pharmacopoeia.

It would seem easier at present than ever before to adhere to these basic principles. Each of the professions chiefly interested in the Pharmacopoeia now has its own special book of standards into which preparations of more immediate interest to its members may be introduced: the National Formulary and "New and Nonofficial Remedies."

The National Formulary was founded by the American Pharmaceutical Association in 1888. The committee which prepared it stated that "it was not within the province of the committee to meddle with matters of which the medical practitioner is the proper and competent judge," and added that their object was to establish formulas for preparations which were used either by physicians or the laity and which were not in the Pharmacopoeia.

Thus these two works were designed for special purposes: the Pharmacopoeia as a book of standards for the drugs which the physician finds useful in the practice of medicine; the National Formulary as a standard for various preparations not in the Pharmacopoeia, but which the pharmacist is asked to supply. There seems to be little reason for confusing these functions, especially since the National Formulary has the same dignified standing under the national and state drug laws as has the Pharmacopoeia. The pharmaceutical profession also has a recipe book in which still more preparations, in which its members are especially interested, are described.

"New and Nonofficial Remedies," which is published annually, provides standards for drugs which seem to the physician to be promising and which are developed between the revisions of the Pharmacopoeia and the National Formulary.

It should also be recognized that each profession has its own peculiar interests: the need of the surgeon for drugs and supplies, while urgent, is limited to a comparatively few articles with which the pharmacist is directly concerned. Similarly, the modern drug-store has developed to meet a demand for many things in which the physician is not especially interested. May not this fact account partly, but only partly, for the feeling among some pharmacists that the medical profession does not give the support it might to professional pharmacy?

It is somewhat disconcerting, however, to find that a distinguished ex-president of the American Pharmaceutical Association (D. F. Jones), whose ideas of the relation of the professions of medicine and pharmacy to each other are so strikingly like those of the medical profession, has expressed the view that the Pharmacopoeia seems to have grown of less practical value to the professional pharmacist and the practicing physician. I think that it can be shown that, as regards the members of the medical profession, conditions are changing and that they are appreciating more and more the value of the Pharmacopoeia.

One reason why I speak with so much confidence of the interest, at the present time, of the medical profession in the U. S. P. and of their real and practical loyalty to the work, is based upon the little book, "Useful Drugs," issued by the American Medical Association—the largest association of physicians the world has ever known.

The drugs listed in this book, the eighth edition of which is now in preparation, are selected with but a single purpose: the welfare of the sick. There are no restrictions as to their source; the U. S. P., the National Formulary and the whole group of non-official and proprietary remedies can be drawn upon. The list represents the drugs which large numbers of physicians in active practice voted to be of prime importance, and a few vehicles and flavoring agents.

This list of drugs has been accepted by the national and state boards as the basis for examinations for license to practice and by the medical schools as the basis for the teaching of materia medica and therapeutics, and by leading hospitals as representing the most important drugs.

The number of drugs which it seemed necessary to include in this list may surprise many physicians—there are about 365 of them—more drugs than there are bones or muscles in the body; the drugs are more numerous than the diseases which a physician ever sees. The great war was waged with fewer munitions. And yet physicians are criticized for not prescribing more and still more drugs.

All but seventeen of the 365 preparations in "Useful Drugs" are in the present U. S. Pharmacopoeia.

The founders of the Pharmacopoeia stated in 1820: "The value of a pharmacopoeia depends upon the fidelity with which it conforms to the best state of medical knowledge of the day. Its usefulness depends upon the sanction it receives from the medical community and the public."

It may be that the adoption of the Pharmacopoeia as a legal standard, which necessitates the introduction of the most precise methods of analysis, has tended to diminish its usefulness to the practical pharmacist. But we can hardly begrudge this inconvenience when we think of what it means to the welfare of the people of the United States. These high standards also give the discriminating physician as well as the public greatly increased confidence in the U. S. P. drugs.

Possibly the asserted decline in the usefulness of the Pharmacopoeia to the pharmacist is more apparent than real; it may be a matter of dilution. An ob-

server can not but note the number of drug-stores and pharmacists in the United States, as compared with the number in some foreign countries; it is authoritatively stated, for example, that there are approximately 57,000 drug-stores in the United States, one to less than three physicians. In proportion to the population, the United States has six times as many drug-stores as has Germany.

The physicians have few professional interests aside from the care of the sick; they outnumber the pharmacists by almost two to one; is it not logical to let them determine what shall be included in the work which they themselves established? Of course, physicians at times have been woefully blind—blind for centuries—to the virtue of a drug, but have their colleagues in other fields seen more clearly? Certainly, in one of the most frequently cited cases of this kind, the physicians saw more clearly than did their critics. A recent writer states, as have earlier writers: "In 1880 a British Medical Commission learnedly reported that cocain had no medical value, being at best merely a poor substitute for caffein." No references are given as to where this commission reported, or who composed it. But, in any case, it seems to be forgotten that the really important use of cocain is as a local anesthetic and that this action was not recognized until 1884. Among the uses proposed for cocain before 1884 were the following: insanity, epilepsy, cachexia, bodily and mental exhaustion, melancholia, neurasthenia, hysteria, etc. It was also proposed to give it to soldiers and sailors to appease hunger and thirst and to relieve fatigue. The thought of cocainized armies and navies is rather appalling—our Army and Navy have had sufficient troubles with individual cases of cocain addiction. May not the "British Medical Commission" (whoever composed it), which is said to have reported adversely on the internal use of cocain, have been rather wise in their day and generation?

An examination of the preparations in "Useful Drugs" also shows that there are not as violent and as radical changes in the physician's use of drugs as many seem to believe. More than half of the preparations in "Useful Drugs" were in the Pharmacopoeia of the Massachusetts Medical Society of 1808. It is almost startling to find so many of the standard remedies of to-day in this 122-year-old book. The salts of iron, mercury, silver, copper, arsenic, antimony and zinc were there, as were also opium, digitalis, cinchona, ipecac, aloe, rhubarb, senna, chenopodium, sulphur and many others. Ordinary ether and the spirit of ether were there, although the most important action of ether—the production of general anesthesia—was not recognized until thirty-eight years later.

Chairman Cook has recently pointed out that, of the 305 individual therapeutical agents in the latest revision of the U. S. P., 114 were official in the U. S. P. of 1820—another illustration of how wisely our earlier predecessors selected the articles for the Pharmacopoeia.

Progress in drug as in other forms of therapeutics often seems very slow, and every one is painfully conscious of the great gaps to be filled. But, looked at from a broader point of view, the progress has been very encouraging. The drugs in the first edition of the U. S. Pharmacopoeia represented the achievements of mankind in this field in all the ages; some of the most important drugs (opium and its preparations, metallic mercury, etc.) were in the pharmacopoeia of Dioscorides of A. D. 77. The additional drugs in the tenth revision represent the advances in a single century.

This convention is the only representative organization in a great country devoted to the scientific consideration of drugs; it is the only place where pharmacists, chemists and physicians come together. Would it not be proper to consider briefly means by which new therapeutic agents may be added to what are already available? Every such addition increases the usefulness of the professions to the public and adds to the standing of both physicians and pharmacists in the community.

I may call your attention again to the wording of our articles of incorporation: the "encouragement and promotion of the science and art of medicine and pharmacy by selecting by research and experiment and other proper methods—such materials as may properly be used as medicine."

What was the source of the medicines in the U. S. Pharmacopoeia at present? How were their medicinal properties discovered? I mentioned how, speaking in very general terms, the drugs of outstanding, universally recognized value—the sort of drugs which led Sydenham to make his famous remark that without opium few would care to be physicians—fall into two groups: those which were available when the first Pharmacopoeia was published and the additional ones to be found in the tenth revision. A physician might hesitate if he were forced to choose between the drugs in the 1820 Pharmacopoeia and the new drugs discovered in the last 110 years. Again speaking in general terms, the drugs of the first period resulted from empiricism, those of the latter period from pharmacological experimentation; the drugs of the former period were for the most part available as such in nature, whereas among those of the latter group there are a large number of synthetic drugs. The plant world will doubtless still yield valuable therapeutic agents; the possibilities of the animal

world are by no means exhausted, but after all there is a limit to what can be expected from these sources. But the field of synthetic organic chemistry has no limits. Already some of our most valuable drugs have come from that field.

Some of the saddest pages in the history of mankind are connected with the failure of physicians to see the therapeutic possibilities in well-known chemicals. Take for example an incident, typical of many, which occurred at the Massachusetts General Hospital about 1821, as described by J. C. Warren: a patient with a dislocation of the hip was given powerful purgatives, a hot bath and then tartar emetic to produce deadly sickness; a vein was opened and blood drawn as rapidly and in as large quantities as possible (the "unholy trinity of bleeding, purging and puking"). Then pulleys were attached to the limbs and power traction exerted for an hour, with occasional intermissions to permit a slight recovery from the pain; but the dislocation was not reduced. A contemporary writer compared the procedure to the execution of a would-be assassin of a king of France: four powerful young horses, attached to the limbs of the criminal, pulled for fifty minutes before the man was torn asunder. Stories are told of how the cords to the pulleys broke and had to be repaired while the patient waited—stories strangely reminiscent of the breaking and repairing of the hangman's rope. The records of successful operations in those days usually closed with the words, "the patient was untied and returned to bed." But these methods were considered by the surgeons of Dr. Warren's time, and earlier, as very humane; Percival Pott remarked in 1779 that the mere relation of the methods used in earlier times was sufficient to shock any humane man. The descriptions of the machines, or, as they were called, "engines" of earlier days strongly suggest that they were transferred from the torture chamber to the clinic; or were they taken from the clinic to the torture chamber? There were stories of thumbs and even arms being torn off by these efficient "engines." Yet patients preferred even this kind of treatment to no treatment.

A drug by the use of which the vomiting and purging and bleeding and the pain in such cases could have been prevented had already been known for nearly three hundred years; Dr. Warren knew it in 1805; he and Dr. Jackson had described its preparation and properties for the Massachusetts Pharmacopoeia of 1808; it was in the first U. S. Pharmacopoeia. For a quarter of a century before the ether day of October 16, 1846, it had been in the very hospital in which Dr. Warren operated; the pharmacist knew it well, for he made it himself and often supplied it to the hospital students for their—politely called—"ether frolics." It was a well-known drug at the time of the American Revolution and during the Napoleonic wars, when a single surgeon sometimes did two hundred amputations in a day. Why this three hundred years' delay? Because the physicians of those days were convinced that they knew enough to state positively that such results as were caused by ether would never be obtained with any drug, and because they had not yet learned to appreciate the value of experiments on animals.

Many analogous scenes could be regalled: patients with lockjaw; blisters produced from ear to ear in the vain effort to secure relaxation of the jaw; teeth broken so that a few drops of water or milk could be given. Or consider the scenes in the tetanus hospital at Gettysburg: sentries removed far from the hospital so that the sound of their footsteps would not throw the inmates into spasms, or the night when a wind arose and rattled the windows and the wounded soldiers passed the night in one painful convulsion after another. Contrast this scene with one in a German military hospital in 1915. Again patients with lockjaw; unable to swallow; excruciatingly painful cramps, intense cyanosis. A small amount of a solution was injected into a vein: in two minutes the convulsions ceased, pain disappeared; the patients were soon eating, drinking, reading, playing cards, laughing. Or consider a scene at the Massachusetts General Hospital: a child in strychnine convulsions; life maintained by artificial respiration. A few drops of a solution injected into the spinal canal: instant recovery; in a few minutes, child interested in toys; no return of the convulsions.

And the drug in these cases was Epsom salt, well known to the medical profession since 1694 and, of course, in all the older Pharmacopoeias. But no one seemed interested until 1905 in determining what this drug would do when injected into an animal or a man.

Just one more such picture: "There was one poor man in the wards suffering dreadfully from angina pectoris; he used to have an attack every night and for two hours the unfortunate man would sit on the edge of his bed and could not move forward, backward, or to one side, with his face pale and sweat pouring off it, in perfect agony." Three or four drops of a drug were inhaled. The impossible happened: "instant and complete relief" in this most painful condition. And the drug, amyl nitrite, had been well known to chemists for twenty-three years.

The same story with acetanilid and similar drugs: relief may be obtained anywhere in the world for a few cents, which fifty years ago was beyond the reach of any potentate or Croesus. The bromides which in 1853 first brought relief to one of the longest

known and most distressing diseases, chloral hydrate, cocain, phenol and many other drugs were well known to chemists long before they were to physicians. Arsphenamine, introduced into medicine in 1910, is, from the chemist's point of view, only a slight modification of the arseno-benzene known since 1875, but it required the genius of the pharmacologist Ehrlich to see how the comparatively simple process of the introduction of hydroxyl and amino groups into this old and uninteresting compound would result in a drug which has so changed the outlook in syphilis and other serious diseases.

The discovery of the anesthetic action of ether has been described as "the most important event in surgical, and one of the most important events in human history." You remember Weir Mitchell's lines:

> Whatever triumphs still shall hold the mind,
> Whatever gift shall yet enrich mankind,
> Ah! here no hour shall strike through all the years,
> No hour as sweet, as when hope, doubt and fears,
> 'Mid deepening stillness, watched one eager brain,
> With God-like will, decree the Death of Pain.

But the introduction of ether had no effect upon the mortality of operations at the Massachusetts General Hospital. About two decades later, however, the number of operations began to increase at a rapid rate and there was a wonderful reduction in mortality. Operations scarcely dreamed of before were performed almost daily. A new drug, which was destined soon to have a greater influence upon medicine than ether, had been placed in the hands of the surgeon. And where had it been found? At a sewage disposal plant in Scotland. Lister thought that the carbolic acid which checked the putrefaction of sewage might check the putrefaction in wounds. This soon led to aseptic surgery, and another new era in medicine had begun. A medical orator stated: "Hand-in-hand, equal benefactors, anesthesia and asepsis march calm and triumphant"—but this impressive procession did not start for three hundred years after the discovery of ether and about fifty years after the discovery of carbolic acid.

Anesthesia and asepsis came when the medical profession had demonstrated to their own satisfaction that these were impossible.

How needlessly pessimistic have physicians been at times in regard to the discovery of new drugs is shown by that often quoted, or misquoted, but apparently not often read, essay on "Self-Limited Diseases" by Jacob Bigelow, one of the authors of the first edition of the U. S. Pharmacopoeia. Bigelow, writing in 1835, placed epilepsy and angina pectoris among the "self-limited diseases" in the sense that, as he says, the paroxysms of these "can neither be foreseen, prevented, nor, as far as we know, materially abridged in their duration."

How easily satisfied was Bigelow with the results from now almost discarded drugs is shown by his remark: "Thirty years ago, we might have added gout to the opprobrious list under consideration"; but states that gout might now be withdrawn from the list since colchicum and veratrum and abstinence from alcohol had so markedly lessened the frequency and violence of the attacks. The bromides, which are certainly far more efficacious in epilepsy than are colchicum and veratrum in gout, were well known to chemists when Bigelow wrote the above; amyl nitrite was discovered soon afterwards. Bigelow also made the remark, which seems never to be quoted: "In regard to the diseases which have been called self-limited, I would not be understood to deny that remedies capable of removing them may exist. I would only assert that they have not yet been proved to exist." However, in some mysterious way, this article, or the interpretation placed upon it, seems to have convinced the medical profession for generations that it is useless to look for new drugs of value. This attitude is strikingly evident in the dozen or more ether day addresses.

For many years ether day was celebrated with solemn pomp at the Massachusetts General Hospital; this was stated to be a day on which the adherents and friends of the hospital were accustomed to "take account of stock and to ask for such visions of the future as may guide it fruitfully." It might have been more appropriate to have observed the day as one of humiliation and repentance for the needless agonies inflicted in the three hundred years which elapsed between the discovery of ether and its application. But not one of the distinguished speakers seemed to have grasped the real meaning of the discovery: how it was possible to obtain with an ancient drug results which science and religion alike had taught to be impossible.

Nor was attention ever called to the fact that there were known in 1846 a number of drugs besides ether with which surgical anesthesia could have been discovered; nitrous oxide, ethylene, chloroform, ethyl chloride and bromide and acetylene were all well-known chemicals at that time.

The subject of surgical anesthesia was often treated as if it were a closed chapter; but steady progress is being made, as shown by the recent introduction or reintroduction of ethylene, and of various new local anesthetics, as well as of new general anesthetics. But the question should be seriously considered if man has even got on the right track in regard to general anesthesia. The effective anesthetic dose of the present general anesthetics is more than 50 per cent. of the

fatal dose—a smaller margin of safety than with any other class of important drugs. The essential action of anesthetics seems to be the blocking of the passage of impulses to the brain at certain synapses; impulses coming from the brain to peripheral organs may be blocked by drugs in a thousandth or even millionth of the fatal dose.

Another slogan which has done much to retard rational therapeutics is the "healing power of nature." Nature is certainly not very active in healing cancer, syphilis, tetanus, amebic dysentery, yaws, diabetes, myxedema, hookworm and many other diseases, many of which may now be relieved or cured by drugs. There is truth in Benjamin Rush's famous remark that nature should be turned out of doors and efficient art substituted for her.

Not only can the introduction of almost every modern drug into medicine be traced straight back to pharmacological experiments, but the rational use of some of the older remedies is almost wholly dependent upon such experiments. Even the underlying pathological conditions have often been elucidated by such work. To-morrow will be the twenty-fourth anniversary of the presentation to a medical association meeting in this hotel of a paper by two modest pharmacologists (the late Professor Cushny, and Edmunds, whom we have with us to-day) in which an explanation was offered for the first time of the condition (auricular fibrillation) in which digitalis produces its most spectacular results.

These pharmacologists were also largely responsible for the introduction into medicine of physiological standardization. Other pharmacologists, especially Hatcher and Eggleston, developed the subject farther and have done much to place digitalis therapy upon a firm foundation. Still, some of the latest model medical schools do not see any use in pharmacology; the faculties of the old proprietary medical schools often consisted of men of greater vision.

But it is not necessary to pursue this aspect of the subject farther; yon would not be here if you did not have faith in drugs. But what are the possibilities of adding to the list of valuable drugs? Never in the history of the world have the possibilities been so great. When ether, chloroform, chloral hydrate, amyl nitrite, phenol, etc., were introduced into medicine, the number of synthetic organic chemicals was very few; they were numbered in hundreds, or at most in a very few thousands. A year of two ago the organic chemists had already carefully described the physical and chemical properties, method of synthesis, etc., of 258,000 organic compounds; about twenty new ones are being added to the list every day and, if there were a demand for them, they could be increased a hundred fold. Perhaps the pharmacologist would feel that a fair amount of knowledge is available as to the possible therapeutic value of two or three thousand of these; he can find casual references to some of the physiological effects of three or four thousand more, but, even with these, he is prepared for such surprises as occurred in connection with cocain, acetanilid, phenol, simple derivatives of arsenobenzene, etc.

Little indeed is being done to test these new compounds for possible medicinal value; at the present rate of progress it would require not only decades but centuries, perhaps a millennium, for the medical profession to examine what the chemists already have to offer.

No one doubts that an exact knowledge of the cause of disease may be of great value in its prevention or cure. But, in this topsy-turvy world, progress has not proceeded in a logical way. Some of the formerly most deadly diseases (smallpox and yellow fever) were the first to be effectually controlled, although even their causes are still unknown. More progress was made in the cure of malaria and syphilis long before their cause was discovered than in such diseases as pneumonia and tuberculosis, concerning which there is a large amount of exact knowledge. Only the most imperfect knowledge as to pathogenic bacteria was available when Lister revolutionized surgery and medicine by the use of phenol.

Empiricism gave us some drugs and poisons with a highly specific action: quinine and emetine ferret out and, under favorable conditions, destroy, the organisms of malaria and amebic dysentery; atropin paralyzes the ending of parasympathetic nerves; epinephrin stimulates the endings of the sympathetic; cocaine paralyzes the endings of sensory nerves, etc.

Pharmacology is duplicating these achievements of nature: malaria, amebic dysentery, syphilis, yaws, etc., yield to synthetic drugs.

There are many considerations which should tend to encourage the hope that a diligent and really intelligent study of the chemotherapy of cancer, for example, might lead to a cure before the cause is discovered. The highly selective action of drugs upon certain tissues is very suggestive; it was almost startling, for example, to have seen many cases in which methyl alcohol had destroyed a few cells in the retina and caused complete blindness, without there being the slightest indication of injury to other organs or tissues. May there not be in the vast number of known but untested compounds some which may have a similar effect upon the cancer cells? A person thinks again of the number of drugs known before 1846 with which anesthesia might have been produced.

Haphazard, random experiments in such a field avail no more than would similar experiments have

helped Ehrlich in his search for arsphenamine. Ehrlich's knowledge of chemistry and pharmacology was so enormous that he could quickly eliminate many compounds from further consideration; he would draw a circle and, after a few experiments, divide it into two and remark that only the compounds in one half of the circle seemed promising; later he would again draw a line and study the compounds in only one quarter, and so on.

Somewhat similar methods can and have succeeded in other fields of pharmacology, as well as in the chemistry of dyes. Ehrlich early recognized in cocain a group which he called an anaesthiophore group, analogous to the chromophore group of the dye chemist; the recognition of such groups has been the basis of the development of other local anesthetics.

The pharmacologist can already predict with a high degree of certainty what chemical compounds will have a "muscarine" or a "curare" or a "stimulating" or a "paralyzing" nicotin-like action. The central atom in such compounds may be nitrogen, sulphur, arsenic, etc.; but if certain side chains are present, the pharmacologist can be certain that the compound as a whole will have one or other of the above actions.

Time does not permit of more than the briefest possible consideration of the means by which work in this field can be speeded up. A comparison of the tenth with the fifth revision of the U. S. Pharmacopoeia indicates the progress made in fifty years. Among the important therapeutic agents added in this period are the arsphenamines, cocain and all other local anesthetics, every effective hypnotic, every analgesic (acetanilid, cinchophen, etc.), the salicylates, the nitrites, bromides, the antitoxins, nearly all the antiseptics, etc. Nobody questions for a minute the great value of these drugs. It is also evident that the United States has scarcely made a single really original contribution to this list. The great majority of these drugs were discovered in Germany and most of them in the pharmacological and other laboratories of the German universities or in special research institutes. At the present time, there is scarcely a university pharmacological laboratory in the United States the equal of a number in Germany forty or even fifty years ago.

There is no institute in the United States comparable to the one founded for Ehrlich at Frankfort in Germany. The contributions of Ehrlich to serum therapy had been so important that it was proposed to call the Frankfort institute a serum institute. Ehrlich, however, insisted that it be called an institute for experimental therapeutics and at the first opportunity practically abandoned work with serums and returned to pharmacology, to which he had already made important contributions. Just twenty-eight years ago, Ehrlich expressed the view that the "future of medicine lay in pharmacology." He was convinced, however, that the ideals of the pharmacologists had been unnecessarily low and chose to limit his work largely to one field of pharmacology which he later called chemotherapy. But the methods he pursued were the same as those he had used in his pioneer work on analgesic drugs, the therapeutic use of dyes and his fundamental work on cocain. (It may be remarked parenthetically that Ehrlich's famous side-chain theory originated from this cocain work; recently published letters of Ehrlich show the impatience he felt with what he called the stupid people who never realized that his conception of side-chains was wholly that of the organic chemist.) Ehrlich was able to make rapid progress in this field owing to his extraordinary knowledge of organic chemistry and his encyclopedic knowledge of pharmacology, and also his complete freedom in research.

It is not unusual in the United States for considerable sums of money to be made available for the discovery, for example, of a cure for cancer, an improved drug for syphilis, etc. Such gifts come from the heart rather than from the head. I saw such an experiment tried in Ehrlich's Institute. Ehrlich had accepted funds for a study of the therapy of cancer; the work began with enthusiasm, but after two or three years the workers were so discouraged that they placed a sign over their door: "Abandon hope, all ye who enter here"; and Ehrlich frequently warned, "Never, never accept money for one specific purpose." The history of arsphenamine was entirely different; the real beginnings of that work were so obscure and so unrelated to either syphilis or arsphenamine that they were never published, but the course can still be followed in the early laboratory note-books. First a purely theoretical study of the relation of the vinyl linkage in the quinine molecule to toxicity; there was no thought at that time of any possible relation of these compounds to pneumonia, but years later it was found that one of these came nearer to being of use in this disease than any previously known drug. The effects of the quinine compounds were studied upon various protozoa and then upon the organisms of sleeping sickness, but without encouraging results. Then pentavalent arsenic compounds were studied in connection with sleeping sickness, then various trivalent arsenic compounds, then arseno compounds. Finally, the arseno compounds were studied in connection with experimental syphilis of the rabbit, and the result was arsphenamine. Had Ehrlich been limited to a study of the compounds of quinine or sleeping sickness, or of any one group of arsenic compounds, arsphenamine might never have been discovered.

You remember how Woehler tried to make ammo-

nium cyanate and obtained urea, an observation which broke down the distinction between compounds formed as the result of so-called vital forces and ordinary carbon compounds, and how the experience of Woehler was compared to that of Saul, who was said to have gone forth to seek his father's asses and discovered a kingdom.

Conditions have never been as favorable for the development of such work in the United States as at present. Organic chemicals which a few years ago were imported from Germany in gram lots are now obtainable in tank cars. There are hundreds of chemists eager to cooperate with the medical profession in the investigation of these compounds for possible medicinal value. But not only are there at present few facilities for such work, but it is difficult for manufacturers to obtain trustworthy data even as to the possible poisonous properties of their products.

Within the last year or two funds aggregating nearly a million dollars have been available for research in pharmacology, some of which had very important bearings upon the treatment of disease and the public health, but great difficulty was found in finding laboratories equipped for such work; in many cases none was found.

Of course, we all appreciate what some American manufacturers are doing in this field; how, for example, they have completely relieved the humiliating situation in which the United States found itself at the beginning of the World War when no local anesthetics or modern arsenicals and few hypnotics were available. And American laboratory workers and physicians deeply appreciate the many courtesies and assistance which these firms are always ready to give. But, with a few notable exceptions, distinctly new fields have seldom been opened. The chances of making the books balance in work of this kind are small and not infrequently new drugs are placed on the market with the frank admission that there has been pressure from the sales department.

Pioneering work in this field has usually been done, as it should be done, in endowed institutions and has been pursued largely as a branch of pure science just as was the work which has led to the applications of electricity. It is just this pioneering work which at present is so much neglected in our universities and research institutions.

Perhaps some of those who have made large fortunes in the drug or chemical industry would be glad of an opportunity to aid in the founding of an institute analogous to that at Frankfort, the purpose of which was stated to be the study of therapeutics and which, under Ehrlich's direction, was devoted chiefly to the study of drugs. Recently, according to press reports, several million dollars acquired in the drug business were willed to a university; the undergraduate students are reported to be busy arguing whether this should be used for the promotion of athletics or for building more dormitories. Professor Lusk recently remarked: "We are building great comfortable homes for the students in our colleges; we are planning pent-house apartments for the internes in our hospitals. But who is concerned with the material welfare of the professor? The answer is, virtually no one. No pent-house apartments are thought of for him." But after all it matters little about the professors who are already in the work; they could not get out if they would. It is discouraging, however, to see almost every year brilliant and enthusiastic young men and women who are eager to undertake such studies but who soon learn that few institutions offer reasonably good facilities for such work and that the outlook for the future is very dubious in comparison with the opportunities in clinical work, not only as regards facilities, but also for advancement.

It is difficult to avoid the conviction that when the historian of the future discusses the present status of medical research in the United States, when he notes what the study of drugs has already meant to the human race and when he thinks of the quarter of a million or more untested preparations on the chemists' shelves, the present will seem one of the darkest periods in medicine; he may even find a parallel between the attitude of some of those now responsible for the trend of medical research and the complacency of Percival Pott who in 1779 thanked God that his contemporaries (who had ether but did not use it) were not cruel like their predecessors.

I can not conclude these remarks without again expressing my appreciation of the honor of being selected president of this organization. The contact with the officers of the convention and the members of the revision committee has been most pleasant, inspiring and profitable. As an *ex officio* member of the board of trustees, I have been privileged to see something of the business side of the work. No organization could have been more faithfully served. It has had the services of a wise and experienced chairman; those of two faithful and resourceful secretaries; a treasurer who not only looked after the financial problems with the greatest care, but who was always ready to help in a most practical way in any problem which arose; the modest, tactful, fair and broad-minded chairman of the revision committee.

The memory of the association with these and the other members of the board of trustees is one which I shall always treasure.

The convention has suffered severe losses by death,

including three vice-presidents and the secretary of the board of trustees.

It is a sad commentary upon the rate at which we live that it is impossible to do more than merely mention the names of men who devoted a lifetime to the problems in which we are so much interested—such men, for example, as the versatile and lovable Dr. Whelpley, and the charming and scholarly Dr. Power, who achieved preeminence in two countries by his important contribution to the knowledge of plant chemistry.

I can only ask the secretary of the convention to announce the names of the officials of the present convention who have passed away, and, in accordance with custom, ask you to stand for a few moments in honor of the dead.

OBITUARY

RALPH HAMILTON CURTISS

THE death of Dr. Ralph H. Curtiss, professor of astronomy and director of the Astronomical Observatories of the University of Michigan, which occurred on Christmas Day, 1929, brought grief to a wide circle of friends to whom he was endeared by the kindly and lovable traits of his character. To the world of science and to the university which he had served so faithfully and ably his loss is a grievous one. Both by his own researches and through the inspiration and wise counsel generously given to his students and coworkers, he has contributed notably to the advancement of astronomy. It is one of the tragedies of his untimely death that he was about to see the realization of the project for a new and larger observatory in a more suitable location for which he had planned and worked unceasingly. During his last illness the land for the observatory site was purchased, and it is to be hoped that the new edifice will be constructed in accordance with his plans as a fitting tribute to his memory.

Ralph Hamilton Curtiss was born at Derby, Connecticut, February 8, 1880, of Puritan parents, Hamilton Burton and Emily Wheeler Curtiss. The early training in this Puritan home, ordered in accordance with the fine traditions of the stock, left a lasting imprint upon his character and was reflected in many of the outstanding qualities which characterized his life —a high sense of duty and justice, untiring devotion to his work and a deep appreciation and love of scholarly attainments. In 1892 the family moved to Redlands, California, where young Curtiss received his elementary education, graduating from the local high school at the age of sixteen, with high honors.

After a year spent in working and saving to provide funds for his college education, he enrolled in the fall of 1897 as an undergraduate at the University of California, where for the next four years he not only maintained a high scholastic record, but entered enthusiastically into the many activities of student life. He was a good "mixer," popular in his fraternity, Delta Tau Delta, and in fact with all his associates, both students and faculty. To his genial and lovable traits was added the rare talent of a musician. He was a member of the University Glee Club and played the violin with unusual skill. Early in his academic career Curtiss was attracted especially to the science of physics largely through the influence and inspiration of the late Professor E. P. Lewis. Later he was drawn to astronomy by another great and inspiring teacher, Professor A. O. Leuschner, and he seems to have decided as early as his junior year to become an astronomer. Recognition of the excellence of his work as a student came through election to Phi Beta Kappa in his junior year, and of his standing in astronomy by his appointment the following year as an assistant in the Students' Observatory.

Early in 1901, with the requirements for graduation practically completed at the middle of his senior year, Curtiss was sent as a member of the Lick Observatory expedition to Padang, Sumatra, to observe the total solar eclipse of May 17–18. The degree of bachelor of science was conferred upon him by the University of California in 1901 during his absence on eclipse duties. There followed three years of graduate study in astronomy at Berkeley and Mount Hamilton, during which time he held one of the Lick Observatory fellowships. His work in this period laid the broad foundation for the future brilliant and successful career in his chosen field. He was equally conversant with the theoretical and the observational side, whether the subject lay in the older field of astronomy or in that of astrophysics. Keen and active of mind, skilful in the manipulation of instruments, untiring in his devotion to work, he was recognized by the members of both departments as a man of outstanding ability and scholarly attainments. At the Lick Observatory he made an extended spectrographic study of the Cepheid variable W. Sagittarii. In the course of this work he showed that low dispersion could be applied successfully to the determination of the radial velocities of stars of the later spectral classes through the use of a method which he developed for the measurement and reduction of the spectrograms. This method, to which he gave the name of "zero standard," satisfactorily eliminates the errors arising from uncertainties in the adopted wavelengths of the lines produced by the effect of blends,

and has since found wide application in radial velocity work. The results of this investigation were presented as his doctor's dissertation under the title "I. Proposed Method for the Measurement and Reduction of Spectrograms for the Determination of the Radial Velocities of Celestial Objects. II. Application to a Study of the Variable Star W. Sagittarii." The degree of doctor of philosophy was conferred upon him in 1905 by his alma mater.

In May, 1905, Dr. Curtiss was appointed assistant astronomer in the Allegheny Observatory, where the following two years were devoted, in collaboration with Director Schlesinger, to the initiation and development of the spectrographic program. When plans were formulated for astrophysical research at the Observatory of the University of Michigan, Dr. Curtiss was called to this institution in 1907 as assistant professor of astrophysics and placed in charge of the development of this phase of the observatory's activities. Under his supervision a spectrograph of one-prism dispersion was constructed from his design for use with the new 37½-inch reflector, and a program of spectrographic observations for certain interesting classes of stars was undertaken with marked success. Four years later he was promoted to associate professor and assistant director of the observatory and in 1918 became professor of astronomy. In March, 1927, he was appointed director of the Observatory of the University of Michigan in succession to William J. Hussey, whose death occurred while he was *en route* to Bloemfontein, South Africa, the station of the Lamont expedition for the observation of southern double stars. The work at this station was organized under the direction of Professor Curtiss in accordance with Professor Hussey's plans and is being ably carried on by Dr. Rossiter.

Since 1911, Professor Curtiss had not only directed the spectrographic program of research at the observatory, but had given graduate courses in spectroscopy and astrophysics, in addition to the more elementary work in descriptive astronomy in the university. During the war he offered courses in navigation, which were attended by hundreds, some of whom later saw service with the naval forces of the country. His lectures were clear and concise, and were presented in a careful and pleasing manner. He was an inspiring teacher and he had the faculty of imparting to his students some of his own high ideals of scholarship and enthusiasm for research. His students learned to respect and love him for his manly qualities, for the fairness with which he treated every question concerning them and for the sincere interest he took in their welfare. Most of those taking the doctorate in astronomy at the University of Michigan in recent years worked under his direction and the high quality of their researches is eloquent testimony to his ability as a scientific teacher and director of research.

Professor Curtiss's researches and those of his students were confined principally to the field of stellar spectroscopy, but in this they cover a wide variety of subjects. As the result of his earlier experience at the Lick Observatory he quite naturally turned his attention to the rich field offered by the use of low dispersion instruments and in particular to the application of such instruments to the study of stars having early type spectra, which on account of the character and small number of the lines are especially suited for observation in this manner. That this field proved a most fruitful one under his cultivation is shown by the number of important papers which came from his hand. His most extended investigation and one of his most important contributions relates to a study of Class B stellar spectra containing emission lines. The program of observations begun at Allegheny and continued at Michigan consisted, in addition to a few spectrograms on each of a number of these stars, of a long series of plates on several typical objects for a detailed study of the intensities and widths of the emission lines, and in particular for following the changes in intensity and position of the lines that occur in spectra of this class. These researches are described in detail in six memoirs appearing in the *Publications of the Detroit Observatory,* while the results of his more recent investigations on this subject were in course of preparation for publication when he was stricken with fatal illness.

From the beginning Dr. Curtiss realized that the solution of the problem of the physical nature of the Class B stars whose spectra exhibit bright lines was to be obtained only through a thorough and systematic study of these spectra and that to secure the necessary observations would require many years. It was along these lines that his investigations were planned. To unravel the intricate details on the fine series of spectrograms required no little patience and skill. Finally, the results were collected and their bearing upon the probable physical conditions existing in the stellar atmosphere critically discussed. Among the many important results of these researches we may note the interesting relation found to exist between the widths of the emission lines and their wave-lengths, a relation which he has interpreted on the basis of certain plausible assumptions concerning the distribution of vapor density at different atmospheric levels in which the various emission lines have their origin. Many of the perplexing problems concerning the peculiar behavior of the bright-line B stars still await the final answer, but as the result of Curtiss's researches a very important advance has been made toward the solution of some of these.

Studies of the two eclipsing variables, Algol and β Lyrae, made by Professor Curtiss have yielded most important information concerning these very interesting systems. In the former system he was able to show conclusively the presence of a third component having a period of 1.9 years. Minor irregularities in the observed velocity curve of Algol suggested another problem, solved several years later by one of his students at Michigan, Dr. D. B. McLaughlin, who found that these are produced by the rotation of the bright component. His pictorial study of the spectrum of Nova Geminorum II, representing the spectral changes in the star observed at the Michigan Observatory, furnished data of great value, which in combination with the observations of others enabled some of the more important variations occurring in the spectrum of this nova to be traced.

For the past few years Professor Curtiss had been engaged, with several of his colleagues and students, in an extended investigation of the difference in displacement shown by spectral lines originating at different levels in the atmospheres of Cepheid variables. This effect, discovered at the Michigan Observatory, is one of great importance in connection with the problem of Cepheid variation, and its final elucidation should throw considerable light upon the complex motion taking place in the atmosphere of a pulsating star.

Dr. Curtiss's published researches are contained in some eighteen memoirs, appearing in the *Publications of the Astronomical Observatory of the University of Michigan, Bulletin of the Lick Observatory, Publications of the Allegheny Observatory* and in astronomical journals. In addition he contributed a number of shorter papers to current astronomical literature. He had just completed the chapter on "Classification and Description of Stellar Spectra," which he was preparing for the fourth volume of the "Handbuch der Astrophysik." Several extended investigations were also in a well-advanced stage and it is hoped that these will be completed by his colleagues at an early date.

Recognition of his scientific work came to Professor Curtiss from many learned societies. He was a fellow of the Royal Astronomical Society, member of the American Astronomical Society, of the Seismological Society of America, Phi Beta Kappa, Sigma Xi, a fellow of the American Association for the Advancement of Science and a member of Commission No. 29 "On Stellar Spectra" of the International Astronomical Union.

Professor Curtiss is survived by his widow, Mary Louise Welton Curtiss, to whom he was married in 1920, and by a brother, Dr. David Raymond Curtiss, professor of mathematics in Northwestern University. Dr. Curtiss was fond of his home life and was never so happy as when playing the host to one of his colleagues. He took an active interest in civic affairs and in the social life of his community. In the world of science he was recognized as a leading authority on stellar spectra, our knowledge of which he has enriched through a long line of most fruitful researches. As an investigator he exhibited marked skill and originality in the treatment of difficult problems, patience and extreme care in the consideration of every detail of the work to the end that the data should have the maximum precision, and finally true scientific caution in the interpretation of his observational results. He was a scientist of wide vision and high ideals and possessed to an unusual degree the power of stimulating others.

J. H. Moore

Lick Observatory

SCIENTIFIC EVENTS

THE UNITED STATES BUREAU OF FISHERIES

Work on the nation-wide five-year construction and maintenance program has been begun by the Bureau of Fisheries in accordance with the act of Congress approved on May 31, according to an oral statement made by the Deputy Commissioner, Lewis Radcliffe, on July 8 to the *U. S. Daily*. One important feature of the act is that provision is made for cooperation between the bureau and states, counties, municipalities, individuals and public and private agencies.

The bureau may also accept donations of lands, funds and other aid to the development of the program under the provisions of this act. It authorized additional appropriations for new stations, laboratories and distribution cars to the amount of $1,885,000; annual increases in appropriation for the division of fish culture of $100,000, and increase in appropriation for the divisions of inquiry and fishery industries at the rate of $60,000 and $35,000 per annum for the five-year period, he outlined.

Of the increase for the fish culture division not more than 30 per cent. is for salaries and for the other divisions 40 per cent. The total increases for the fifth year authorized for the three divisions will be $50,000, $300,000 and $175,000, respectively.

Authorizations for new construction by years follow:

Fiscal year beginning July 1, 1930: Fish-cultural stations—New Mexico, $50,000; Louisiana, $50,000, and

Idaho, $60,000. Substations—Wisconsin (southern), $50,000; Montana, $35,000; Colorado, $35,000, and New Hampshire (White Mountain Forest), $25,000. A fishery laboratory in Washington, $125,000, and an experimental bass and trout station, Maryland or West Virginia, $75,000.

Fiscal year beginning July 1, 1931: Fish-cultural stations—Alabama, $50,000; Indiana, $50,000; Tennessee (middle), $50,000, and Pennsylvania (including a substation), $100,000. Substations—South Carolina (or enlargement of Orangeburg station), $25,000; Texas (western), $35,000; New York, $35,000. The purchase of Mill Creek station in California, $20,000, and the purchase and repair of Rogue River substation, Oregon, $35,000.

Fiscal year beginning July 1, 1932: Fish-cultural station—Florida, $60,000. Fish-cultural substations—Maine (including enlargement Craig Brook), $50,000; Virginia (eastern), $75,000, and Minnesota, $50,000. A fishery laboratory in Texas (Gulf coast), $75,000, and the purchase or construction of steel fish-distribution car, $75,000.

Fiscal year beginning July 1, 1933: Fish-cultural stations—Nevada, $60,000; Illinois, $75,000, and New Jersey, $75,000. Substation — Mississippi (southern), $50,000, and the purchase or construction of steel fish-distribution car, $75,000.

Fiscal year beginning July 1, 1934: Fish-cultural substations—Ohio, $35,000; Kansas, $35,000; North Dakota, $35,000; Georgia, $35,000, and the purchase and repair of Little White Salmon station in State of Washington, $35,000. A fishery laboratory in the territory of Alaska, $50,000, and an experimental and bass and trout station in Pisgah National Forest or Great Smoky National Park in North Carolina, $35,000.

AWARD OF THE STORROW FELLOWSHIPS

THE Storrow fellowships in geology and geography are based upon a fund of $5,000 placed with Mr. Arthur Keith, chairman of the division of geology and geography of the National Research Council, by Mrs. J. J. Storrow, of Boston, Massachusetts, for the promotion of training in research in those branches. In the allocation of the fund the committee on fellowships of that division has given primary consideration to aiding outstanding students in these fields to make successful beginnings in research careers, rather than to securing advanced degrees. It has even held that it is not necessary for the candidate actually to be engaged in university study at the time of his application for aid in further training.

Following are the recipients announced by the committee through the National Research Council: H. J. Fraser, Cambridge, Massachusetts; Norman Hinchey, St. Louis, Missouri; Ralph L. Lupher, Pasadena, California, and Jerome S. Smiser, Princeton, New Jersey.

So meritorious were the cases presented that the fund was fully allocated for the coming year. Nothing could more unmistakably show the great need for research fellowships available to graduate students in geology and geography than the applications and supporting letters received since the announcement of these fellowships was published in SCIENCE in mid-January. They reveal the existence of a large group of young men of fine character and ability who have graduated from the universities and who are pressing for special training with a view to entering definite research careers in different branches of our subject. Applications stating present training and specific research objectives and plans are supplemented by letters relating to the character, training, ability, industry and special aptitude of the candidates for the particular line of work in view. Among the group of selected cases remaining there are enough of distinctly high rank and promise to make profitable use of a fund of $20,000 a year. Some of these cases are opportunities to launch trained and ambitious young men into productive contribution to the knowledge of geology and geography.

Most of the applications relate to geology, and of these more of the outlined plans lie in the fields of invertebrate paleontology than in any other single subject. Four applications fall within the broad province of geography.

A very interesting though small group of applications are from men no longer in the universities who have developed perspective and purpose relating to certain fields or problems of research which they wish to enter upon but which they can not undertake without aid or for which they can not insure the necessary preparation without funding which, in most cases, is on a very modest scale.

The committee hopes that the demonstration of desire on the part of young men and women to engage in research in geology and geography, the ability and earnestness of purpose indicated, and the generally practicable as well as meritorious plans in view will appeal to persons of means who are interested in the promotion of research in geology and geography.

DAVID WHITE,
Chairman, Committee on Fellowships
DIVISION OF GEOLOGY AND GEOGRAPHY,
NATIONAL RESEARCH COUNCIL

AWARDS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

FOR outstanding achievement five engineers received awards at the opening session of the sixtieth annual convention of the American Society of Civil Engineers which opened at Cleveland on July 9.

A gold bronze medal, the first prize in the annual Phebe Hobson Fowler professional award, was be-

stowed upon Arthur W. Berresford, of New York, "in recognition of his particularly efficient administration of the American Engineering Council during the two years of his incumbency as its president."

Since his retirement as head of the council on December 31, Mr. Berresford has been managing director of the National Electrical Manufacturers Association. The council was organized in 1919 as the public-service body of the engineering profession of the United States with Mr. Herbert Hoover as its first president.

Mr. Berresford was born in Brooklyn, N. Y., July 9, 1872. He is a graduate of Brooklyn Polytechnic Institute and of Cornell University. He is a past president of the American Institute of Electrical Engineers, of the Associated Manufacturers of Electrical Supplies and of the Electrical Manufacturers Club. He is a former vice-president and general manager of the Cutler-Hammer Manufacturing Company of Milwaukee, with which he was connected from 1900 to 1923. He was also vice-president of the Electrical Refrigeration Corporation of Detroit, now the Kelvinator Corporation. He is a member of numerous organizations, including the American Society of Mechanical Engineers, the Society of Naval Architects and Marine Designers and the Detroit Engineering Society.

A silver bronze medal, second prize in the Phebe Hobson Fowler award, went to J. Vipond Davies, of New York, "in recognition of his accomplishment as chairman of a committee of the American Society of Civil Engineers which developed the 'Report on Charges and Method of Making Charges for Professional Services,' adopted by the Society."

Mr. Davies was president of the United Engineering Society from 1920 to 1923. From 1920 to 1928 he was a member of the Research Board of the Engineering Foundation. He was born in Swansea, South Wales, on October 13, 1862, and is president of Jacobs and Davies, Inc., consulting engineers of New York City. He has been associated with many important engineering enterprises.

Three engineers received prizes in the Phebe Hobson Fowler architectural award as follows: First, Morris Goodkind, of New Brunswick, N. J., for the design of the Raritan River Bridge at New Brunswick; second, Professor Charles M. Spofford, Massachusetts Institute of Technology, for the design of the Lake Champlain Bridge; third, George F. Burch, of Springfield, Ill., bridge engineer of the Illinois Division of Highways, for the design of the Dixon Springs Bridge, Dixon Springs, Ill.

The awards were established by Charles Evan Fowler, consulting engineer, of 25 Church Street, New York, a member of the American Society of Civil Engineers, in honor of his mother.

AT THE UNIVERSITY OF MISSISSIPPI

The board of trustees of the University of Mississippi at the end of June dismissed a large part of the faculty without warning and without other than political reasons. In addition to the chancellor, Dr. Alfred Hume, those dismissed include:

Dr. P. W. Rowland, professor of pharmacology.
Dr. D. H. Bishop, professor of English and head of the department.
Professor J. H. Dorroh, professor of engineering and dean of the School of Engineering.
Dr. J. O. Crider, professor of physiology and dean of the School of Medicine.
Dr. J. N. Swan, professor of chemistry and head of the department.
Dr. C. N. Wunder, dean of men, professor of mathematics and head of the department.
Dr. W. D. Hedleston, professor of philosophy and head of the department.
Robert Torrey, associate professor of mathematics.
L. D. Wallace, associate professor of English.
Mrs. E. L. Eatman, dean of women and professor of home economics.
K. P. Vinsel, associate professor of political science.
Robert Farley, assistant professor of law.
William Hemingway, professor of law.
R. E. Grim, assistant professor of geology.

The Jackson *Daily News* of June 29 says editorially:

> Professors who have given the best years of their lives to the training of the youth of Mississippi, men eminent in the world of education, were summarily dismissed to make way for administration favorites. In a number of instances successors chosen are without experience or qualification for the work they will undertake at the next scholastic term. Men of scholarly attainments grown old in the service, but still highly efficient, are ruthlessly booted out to make way for others whose only claim to recognition is that they need jobs, or better jobs than they thus far have shown ability to fill. The University of Mississippi has been well-nigh slaughtered to make a Roman holiday and when the new chancellor takes charge he will face a task that few men would dare assume.

A correspondent writes: "It is to be hoped that university professors throughout the country will make sure that each of those dismissed is offered a suitable position for the coming academic year."

SCIENTIFIC NOTES AND NEWS

THE Lóczy Memorial Medal of the Hungarian Geographical Society of Budapest, founded to commemorate its former president, Professor Lewis Lóczy, and given in alternate years to a Hungarian and a foreign geographer, has been awarded to Professor W. M. Davis, of Harvard University, "in appreciation of his valuable work in the domain of geomorphology."

DR. R. R. SPENCER, of the U. S. Public Health Service, was awarded the gold medal of the American Medical Association at its annual meeting in Detroit "for original work in preparation of a vaccine for Rocky Mountain spotted fever."

AT the one hundred and fifth annual commencement exercises of Jefferson Medical College, Philadelphia, an honorary degree of doctor of public health was conferred on Dr. Andrew A. Cairns, director of public health of Philadelphia, and a degree of doctor of science on Dr. William Darrach, dean and professor of clinical surgery, Columbia University College of Physicians and Surgeons, New York.

DR. ELIAS P. LYON, dean of the University of Minnesota Medical School, was recently awarded the degree of doctor of science by the University of Southern California.

WESLEYAN UNIVERSITY conferred at commencement the doctorate of science on Dr. Victor C. Myers, professor of biochemistry at Western Reserve University, and on Harold D. Arnold, of the Bell Telephone Research Laboratories of the New York Telephone Company.

THE Royal Faculty of Physicians and Surgeons of Glasgow has decided to confer the distinction of its honorary fellowship upon the three following members of the medical profession: Dr. Robert Muir, professor of pathology in the University of Glasgow; Dr. William Loudon Reid, lecturer on midwifery and gynecology in the Anderson College of Medicine, Glasgow, and Lieutenant Colonel Laurence Austine Waddell, professor of chemistry and pathology at the Calcutta Medical College.

THE Hamilton County Nature Study Club gave on June 14 at Noblesville, Indiana, a dinner in honor of Dr. W. S. Blatchley. Addresses were given on "Blatchley the Man," by Dr. David Mottier, of the department of botany, Indiana University; "Blatchley the Entomologist," by Mr. E. V. Rutherford, principal of Noblesville High School; "Blatchley the Naturalist," by Mrs. H. H. Beals, member of the Nature Study Club; "Blatchley the Geologist," by Dr. E. R. Cumings, professor of geology, Indiana University, and "Blatchley the Neighbor," by Mr. Fred Starr, superintendent of schools, Noblesville, Indiana.

AT a recent election the following officers were elected by the American Society of Plant Physiologists: *President,* Professor H. R. Kraybill, Purdue University; *Vice-president,* Dr. W. E. Tottingham, of the University of Wisconsin; *Secretary-Treasurer,* Professor Wright A. Gardner, of the Alabama Polytechnic Institute.

DR. WILLIAM M. JARDINE, head of the Federated Fruit and Vegetable Growers Association, formerly president of the Kansas Agricultural College and later Secretary of Agriculture, has been appointed minister to Egypt.

DR. RICHARD E. SCAMMON, A.B. and A.M. (Kansas), Ph.D. (Harvard), since 1914 professor of anatomy at the University of Minnesota, has been appointed professor at the University of Chicago.

DR. W. EDWARD CHAMBERLAIN, San Francisco, has been appointed professor of roentgenology and radiology at Temple University School of Medicine, Philadelphia.

PROFESSOR L. T. HOGBEN, of the University of Capetown, has accepted the new chair of social biology at the London School of Economics, University of London.

DR. J. L. SIMONSEN, lately professor of organic chemistry at the Indian Institute of Science, Bangalore, and Mr. F. W. R. Brambell, Lloyd Roberts lecturer in zoology, King's College, London, have been appointed professors of chemistry and zoology, respectively, in the University College of North Wales, Bangor.

DR. C. I. BLISS, of the Bureau of Entomology, will have charge of the technical investigations conducted by the bureau at the new regional laboratory of the tropical, subtropical and ornamental plant insects division, at Whittier, California. The work will deal especially with the resistance to hydrocyanic-acid gas of scale insects affecting citrus fruits.

SURGEON GROVER A. KEMPF, of the U. S. Public Health Service, has been designated a delegate on the part of the United States to the second International Pediatric Conference which opens at Stockholm on August 18.

DR. TAKAO MATSUNO, professor at the agricultural high school of Gifu, Japan, is visiting the United States.

DR. CARL WALTER KOCKEL, of the Geological Institute of the University of Leipzig, will be visiting pro-

fessor of structural geology at the Johns Hopkins University during the next academic year.

The following nominations for officers of the American Society of Mechanical Engineers for 1931 were announced at a recent meeting of the nominating committee held at Detroit, Michigan, during the semi-annual meeting of the society. Election will be by letter ballot of the entire membership, closing on September 23, 1930: *President,* Roy V. Wright, managing editor, *Railway Age,* New York; *Vice-presidents,* William A. Hanley, chief engineer, Eli Lilly Company, Indianapolis; Thomas R. Weymouth, president, Oklahoma Natural Gas Corporation, Tulsa; Harvey N. Davis, president of the Stevens Institute of Technology, Hoboken, New Jersey; *Managers,* W. L. Batt, president, S. K. F. Industries, Inc., New York; H. L. Doolittle, chief designing engineer, Southern California Edison Company, Los Angeles; H. L. Whittemore, chief of the engineering mechanics section, Bureau of Standards, Washington, D. C.; *Representatives on the American Engineering Council,* W. R. Webster, Bridgeport, Connecticut; R. V. Wright, New York, N. Y.; J. W. Roe, New York; Robert Yarnall, Philadelphia; E. N. Trump, Syracuse; B. E. Hull, Houston, Tex; E. O. Eastwood, Seattle; W. Trinks, Pittsburgh; Warner Seely, Cleveland, O., and William S. Conant, Washington, D. C.

At the meeting of the American Association of Museums, held at Buffalo, N. Y., a new section was organized, to be known as the "Scientific Section," intended to include museum curators and others interested in museum problems related to the scientific work as contrasted with the purely educational function. The need for this was evidenced by the large attendance present at the evening meetings. The following sectional officers were elected: *Chairman,* Dr. Roy W. Miner, curator of lower invertebrates, American Museum of Natural History, New York; *Section Secretary,* Dr. Charles J. Fish, director, Buffalo Museum of Science; *Recording Secretary,* Mrs. Margaret Rodgers, Buffalo Museum of Science. The following program was presented, discussions following the reading of the papers: (A) Making Scientific Collections—"Field Work for a Scientific Museum," by Dr. Charles J. Fish, of the Buffalo Museum of Science; (B) Analyzing Scientific Collections—"Problems of the Study of Scientific Material in the Museum," by Dr. Waldo L. Schmitt, of the U. S. National Museum, and (C) Utilizing the Scientific Collections—"The Use of Living Material in Museum Work," by Dr. Frank E. Lutz, of the American Museum of Natural History.

Professor Frank Debenham, of the department of geography, Trinity College, University of Cambridge, England; Dr. H. Schneiderhöhn, direktor des Mineralogischen Instituts, University of Freiburg; Dr. P. Remdohr, professor of mineralogy at the Mineralogisches Institut der Technischen Hochschule, Aachen, and Dr. Otakar Matousek, professor of geology at the Charles University, Prague, are members of the International Summer School of Geology and Natural Resources of Princeton University. Professor Richard M. Field, of the department of geology, is the director. The trip began on June 27 and will extend to August 7. As an essential part of its program, the school offers a course called "The Geology and Natural Resources of North America." This course is given in the field, the party traveling in a specially constructed sleeping, dining and lecture car. The trip this year will cover approximately 11,000 miles in the United States and is planned as a practical demonstration of the relation of geology to natural resources and problems of their utilization. The subjects to be covered as types are: Fuel and power; structural materials, metallics and non-metallics; climate and agriculture; physiography, and transportation and trade. The principal localities which will be visited are: New York Harbor; New Jersey, clay industries; Johnstown, coal and steel; St. Louis, river port and trade; Bedford, stone quarries; Joplin, lead and zinc; Tulsa, oil geology; Fort Worth, cotton and cattle; Grand Canyon; San Bernardino, citrus fruits and southern reclamation; San Francisco, Pacific Port; Sierra Nevada, gold mines; Kelso, lumber; Washington (State), northern reclamation; Coeur D'Alene, silver; Butte and Anaconda, copper; Yellowstone Park; Big Horn Basin; Colstrip, coal; St. Paul, transportation and wheat; Hibbing, iron; Duluth, lake shipping; Detroit, manufactures; Chicago, packing and commerce; Niagara Falls, water power.

The Second International Congress of Comparative Pathology will be held at the Faculty of Medicine in Paris, from October 14 to 18, 1931, during the French colonial exhibition. Professor Achard will be the president, and the subjects to be discussed include tuberculosis, cancer, psittacosis, the ultra-viruses, undulant and *abortus* fevers, anaphylaxis and milk. Further information may be obtained from the general secretary, Dr. Grollet, 7, rue Gustave Nadaud, Paris, 26e.

The scientific society "Antonio Alzate" has organized a second Scientific Congress to be held in the City of Mexico from September 9 to 15. Scientific excursions, and visits to museums, libraries, etc., have been arranged. The congress will meet in eight sections, as follows: *Philosophy*—psychology, logic and ethics; *Sociology*—statistics, political economy, law

and public administration, and teaching and education; *Linguistics and Philology*—general glotology, languages and Indian dialects; *Mathematical Sciences*—pure mathematics, astronomy and geodesy; *Physical Sciences*—physics, chemistry and physico-chemistry; *Natural Sciences*—mineralogy, petrography, geology, paleontology, meteorology, terrestrial magnetism, botany, zoology, anthropology and ethnology, and biology; *Applied Sciences*—medicine and pharmacy, mining, agriculture, civil, military and naval engineering, and architecture; *Eighth Section*—geography, history and archeology.

THE late Dr. William J. Matheson bequeathed $20,000 to the endowment fund of the Long Island Biological Association at Cold Spring Harbor. Dr. Matheson was president of the board of managers of the laboratory for some years previous to its incorporation with the Long Island Biological Association.

THE University of California Museum of Anthropology has received a gift of approximately three hundred tobacco, hasheesh and opium pipes from all parts of the world that have been collected by Dr. W. A. Setchell, professor of botany of the university and chairman of the department during the past thirty years. The collection is intended to show how the common man has adapted and modified pipes to suit local conditions in all parts of the world, chiefly for the smoking of tobacco, which is native to the Americas and was unknown elsewhere until the coming of Columbus. In all there are some 24 from California Indians, 15 from North American Indians, 16 from Central America, 25 from Africa, 91 from Europe, 48 from Asia, 23 from the Philippines, 33 from the South Seas, 3 from South America and others unclassified.

THE *Journal* of the American Medical Association reports that in connection with its eighteenth public assembly, which was held in Heidelberg, May 26, the Emperor William Society for the Promotion of Sciences dedicated the newly erected Institute for Medical Research. The institute, which is located on the bank of the Neckar, combines four independent institutes: the Pathologic Institute, under the direction of Geheimrat Professor von Krehl; the Institute for Physics, under the direction of Professor Dr. Hausser; the Physiologic Institute, under Professor Meyerhof, and the Institute for Chemistry, under Professor Kuhn. The building is a three-storied brick structure, with beautiful lines. The central idea of the institute is the knowledge that the development of modern medicine is closely dependent on the progress of chemistry, physics and physiology. Eminent chemists, physicists and physiologists will undertake here, with a corps of assistants versed in medicine and the natural sciences, research in fields that lie between the sciences and medicine.

MR. VILHJALMUR STEFÁNSSON arrived on June 27, according to the London *Times*, at Southampton from Canada by the *Empress of Scotland* for the purpose of addressing the British Polar Congress on the economic aspects of the Arctic, with special reference to transatlantic flying; and also of engaging in research work at the laboratory of the Royal Geographical Society. In conversation, he said that the British Arctic Air Route Expedition which would set out from England in July was extremely important, for it was planned to survey what was undoubtedly the only practical aeroplane route by which Europe could be linked with the American continent, namely, *via* Scotland, the Faroes, Iceland, Greenland, Baffin Island, and thence to Canada. On that route there was not a single "jump" of more than 300 miles, which would enable an aeroplane to pick up fuel at economic intervals and so carry a maximum pay load. It would not be a very cold journey except over Greenland.

MR. J. E. NEWMAN, of the Institute of Agricultural Engineering, University of Oxford; Mr. Baxter, representing the Farmers Union of Great Britain, and Mr. George Clarke, representative of the Agricultural Laborers of England, are members of a commission that is spending five months in a study of the general methods of agriculture and the application of modern machinery and implements. The members have studied wheat growing in the Dakotas and Saskatchewan, Canada; fruit growing in British Columbia, the Pacific Northwest states and California; vegetable production in California and sugar beets in California and Colorado. The commission is visiting various institutions concerned with agricultural engineering and farm machinery.

ACCORDING to an Associated Press dispatch a group of Russian scientific men led by Professor Otto Schmidt and including Professor R. L. Somoilovitch, Professor D. U. Wiese and several others left on July 4 for Archangel, where they will embark on an icebreaker for Fridtjof Nansen Land, formerly Franz Joseph Land, to explore its possibilities of development. The expedition is equipped with supplies for 15 months. Its members will visit areas upon which no human foot ever before trod. They will explore the Isle of Isolation in the Kara Sea and a considerable part of the polar ocean. They will bring radio operators and other technicians to relieve the present staff of the world's most northern radio station on Nansen Island. The explorers will place upon "North Land," formerly Nicholas II Land, colonists to form a nucleus of a future Russian settlement.

DISCUSSION

INTERNATIONAL COOPERATION IN GEOMORPHOLOGY

THE progress of research in the science of land forms has been carried on without the help of special journals devoted to its development. In the United States most of the papers on the subject have been published in geological serials and a few in geographical serials. The science has also been unfortunate in the lack of agreement as to name. In America it is usually called physiography—an indefinite term. The more appropriate "geomorphology" suffers the disadvantage of length.

Through the enterprise of Austrian geologists and geographers an international journal for the publication of papers on land forms was established in 1926. The *Zeitschrift für Geomorphologie* is edited by Professor Andreas Aigner, of the University of Graz, Austria, and is published by Gebrüder Borntraeger in Berlin at a price of 36 reichsmarks for each annual volume. It is now in its fifth volume and is highly creditable to its sponsors.

Planned as an international journal, it will accept papers dealing with the origin and development of land forms in the principal languages, German, English, French and Italian. Because the initiative has been wholly in the hands of Austrian and German scientists, nearly all the papers so far published have been in German. Contributions in other languages will be welcomed and papers which present material on the larger features of North America or which set forth the American view-point on geomorphological problems are especially desirable.

The four volumes of the *Zeitschrift* that have appeared are particularly noteworthy in quality and in the range of subject-matter. The minor phenomena of erosion, under differing conditions of climate and location, are the subject of articles by von Seidlitz on "spouting holes" due to wave erosion, by Paschinger on "double ridges" in mountain areas, by Bryan on niches and cavities in sandstone, by Stiny on a landslide in Spain, by Brandt on the channel phenomena of streams in an area of low water table, and by other notable authors. Observations in arid regions are set forth by Schultz on the eastern part of the Karakorom desert, by Machatsek on Central Asia and by Passarge and Mortensen on the Inselberg problem. Several articles deal with the Mediterranean region of seasonal aridity, such as that of Winkler on the Island of Mallorca. There are a number of thoughtful articles which make plain the German view-point on general questions of morphological development now so largely influenced by the work of Walter Penck. Among these may be mentioned an article by Braun, once a follower of Davis, who now repudiates the "Cycle of Erosion" as impossible. The short article by Serge von Bubnoff on the piedmont steps of the southern part of the Black Forest is an interesting comment on the work of W. Penck in which it is shown that he confused resurrected pre-Triassic surfaces with more recent partial peneplains.

In addition to original papers the *Zeitschrift* contains reviews of current literature by the editor, Professor Aigner, and also by a distinguished list of associates including Brandt of Prague, Creutzberg of Danzig, F. Jaeger of Basel and Panzer of Berlin. Reviews of the geomorphological literature of North America will be prepared by the undersigned and the geomorphologists of the country are invited to cooperate by sending him separates of their articles in order that no worthy work may be overlooked. Reviews and notices of North American literature began to appear in the April issue of the *Zeitschrift* (Vol. V, Pts. 1 and 2). Articles by American authors intended for publication in the *Zeitschrift* should also be sent to him for transmission to the editor. It is desirable that these articles should deal with principles or with questions and problems of general interest.

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THE PARAGOULD METEOR AND METEORITES

ON the morning of February 17, 1930, at 4:08 A. M., C. S. T., a meteor, hereafter referred to as the Paragould meteor, fell about fourteen miles southeast of Paragould, Arkansas. A large stone whose weight has been determined as 820 pounds and a smaller stone weighing about 80 pounds have been recovered. A third small stone, weighing a fraction of a pound, which was found the day after the fall of the meteor, may be an authentic meteorite. Only a hasty inspection of the little stone was made, however, as the finder would not part with it at the time he was interviewed.

No computation of the path of the meteor through the atmosphere has as yet been made, but a preliminary examination of reports from several states shows that it came from the northeast at a rather low angle. Its velocity was less than that of the average fireball which we have investigated. Its brilliancy was such that at the distance of St. Louis more than one observer reported that he thought an airplane was going down in flames near the local airport. The meteor burst, and one observer at a distance of sixty

or seventy miles claimed he had distinguished three distinct pieces. It became invisible very quickly after bursting, the height of disappearance being about five miles, an unusually low altitude, even where meteorites have been recovered.

Following the disappearance of the brilliant meteor, residents of northeastern Arkansas and the adjoining territory in Missouri and Tennessee were startled by the crash of an explosion followed by a roll like thunder. In the immediate vicinity of Paragould the explosions were severe enough to awaken practically every one from sleep and to stampede stock on the farms. About seventy miles from the point of the fall, at Poplar Bluff, Missouri, the night officer on police duty visited all the banks, thinking that one of them must have been dynamited. Few appear to have been awakened by the explosions at that distance, but an observer of the meteor, at Ripley, Tennessee, reports that her mother was awakened from sound sleep by the explosion, which sounded like a blast of dynamite or a sharp clap of thunder.

Interviews with persons in the immediate vicinity of the fall indicated that the direction of the sounds could not be determined as definitely as when detonating meteors fall in broad daylight. At this hour, 4 o'clock in the morning, nearly every one was indoors, and consequently the reports were less definite as to the direction from which the explosions and sounds came. They do, however, determine reasonably well the location of the two big meteorites which have been recovered and suggest a third large stone which has not been found.

The large meteorite struck in a pasture and went down in rather stiff clay soil to a depth of $8\frac{1}{12}$ feet. This figure is the depth of the hole after the meteorite was removed, that is, the depth to which the bottom of the stone descended. In going down this distance, the stone deviated about one foot to the southwest, the direction of the travel of the meteor. The impact threw a few scattering clods of clay as far as fifty yards. At a distance of thirty feet from the hole the clods were fairly numerous. The eighty-pound stone also struck in a pasture, and the hole from which it was removed was measured as being thirty-four inches deep by a competent civil engineer who also assisted in measuring the hole made by the larger stone. The farmer who found and removed this stone reported that it had entered at a low angle from the southwest, but the civil engineer believed that he was mistaken—that he had been deceived by the way the dirt had fallen into the hole about the stone. From an examination of the marks made by the stone in its descent, the civil engineer reported that it had come from the northeast. As it is known that the meteor came from the northeast, this seems more probable, but from general considerations, we would expect the descent of the stone to be nearly vertical at the time of striking.

The general color of the broken surface of meteorites is, in most cases, a dark, slightly greenish gray. There is, however, much material of a lighter gray. The crust of the larger stone is unusual, and the pitting is not as distinctive as for most meteorites. The smaller stone has a well-developed "brustseite," quite smooth and light-colored. This surface shows scarcely a trace of crust and has hardly a suggestion of pitting. The opposite side, however, shows a strong black crust and is characteristically pitted. An examination of the surface of the larger stone shows grains of nickel-iron standing in relief, while the troilite is depressed. In thin section, chondri can be seen with a microscope. A preliminary chemical analysis has been made by Dr. K. W. Ray, of the chemistry department of the University of Iowa.

The smaller stone is now in the possession of Stuart H. Perry, of Adrian, Michigan, and the large stone is in the possession of the Field Museum of Chicago. A preliminary description of the smaller stone by Mr. Perry appeared with our announcement of this meteor in the April, 1930, issue of *Popular Astronomy*. The 820-pound meteorite is the largest stony meteorite which has been recovered intact. It is exceeded in weight only by the Long Island, Kansas, stone which weighed more than 1,200 pounds, but was broken by striking on a rocky ledge at the time of its fall. The date of fall is not known for the Long Island meteorite. The big Paragould meteorite is exceeded in weight by many irons, but for only one of these is the date of fall given in catalogues of meteorites. This is the Bezerros iron which is listed as having fallen in Pernambuco, Brazil, on May 9, 1915. The estimated weight of this big iron is twenty tons. The second iron in size for which the date of fall is listed is the Boguslavka, which fell on October 18, 1916. The larger iron in this fall weighed about 438 pounds. The third iron for which the date of fall is known fell near Cabin Creek, Arkansas, on March 27, 1886, and weighed 107 pounds. This Arkansas meteorite has for many years held the record as the largest iron for which the date of fall is known, and most recent books still list this as the record for dated irons. It appears that Arkansas has lost the record in dated iron meteorites but now has the record in stone meteorites for which the date of fall is known as well as for stony meteorites recovered intact.

For much information on this meteoric fall, the writer is indebted to W. R. Heagler and Rupert C. Wright, of Paragould, Arkansas. Mr. Heagler, a civil engineer, gave four days of his time to driving over the territory with the writer and securing

interviews with persons who had heard and seen the meteor. He also investigated the hole made by the small stone immediately after the fall and assisted the writer in examining and measuring the hole made by the large stone. Mr. Wright, the editor of the Paragould *Daily Press*, cooperated fully, especially in securing information to supplement that obtained by the writer at the time of his visit.

The last fall of meteorites in the United States, so far as is known to us, was at Tilden, Illinois, on July 13, 1927. The November 11, 1927, issue of SCIENCE carried our announcement of the Tilden meteor and meteorites.

Note added July 3, 1930:

The report of the fall of a big meteorite near Bezerros, Brazil, has not been verified. Among definitely authentic meteorites, iron or stone, the big Paragould is the largest for which the date of fall is known.

C. C. WYLIE

STATE UNIVERSITY OF IOWA

OCCURRENCE OF MAMMOTH AND GIANT BISON IN GLACIAL MORAINES IN THE HIGH MOUNTAINS OF COLORADO

IN June, 1929, the writer, accompanied by Professor J. Hansen, of Western State College, Gunnison, Colorado, and Mr. L. Q. Coffin, examined a reported fossil deposit which had been cut into during the course of the construction of a large ditch in the mountains between Gunnison and Montrose, Colorado. This ditch was built along the west side of the mountain valley of the Little Cimarron, and the deposits are found at an elevation of about eight thousand feet.

The principal formation here is Graneros beds of the Colorado group of the Upper Cretaceous, and they here contain some beautifully preserved fossil fish, with iridescent colors. So far as the writer is aware, these have never been collected and studied from this area.

Pleistocene deposits of coarse gravel, silt and boulders of all sizes lap down over these beds, and most of this appears to be old glacial moraines. In the limited time available for examination of these beds, so far as observed the spots where the fossils were found appeared to be clearly in beds of this origin and near their lower termination.

At Montrose, Colorado, the writer saw some of these bones which had been removed from the deposit. Portions of teeth and a tusk were preserved, not distinguishable from the mammoth type commonly referred to *E. columbi*. With this material was a molar tooth of a very large fossil bison, of the size found in the immense *B. latifrons* and similar species. The writer has had occasion the past year to study several of our extinct bison types, and it is evident that much individual variation exists in many characters, so that, at least until critical studies of all known material has been made, it is unsafe to attempt to identify these species by a single molar tooth.

While scattered, these fossils had been in a good state of preservation when found, and were well mineralized; but the rough handling they had received, with nothing done to preserve them, had naturally resulted in a good deal of damage being done to them.

Mr. L. G. Coffin, the father of the young man who accompanied the writer, was constructing the ditch and discovered the fossil bones. When in Denver recently he assured the writer that the large bison horns he found there were longer than, but not quite so robust as, an immense set of *Bison latifrons* horns now in the Colorado Museum of Natural History, Denver, which were found in the early Pleistocene of Nebraska. These horns are of almost the known limit in size, though not so long as in *Bison regius*. While the writer did not see the specimen, Mr. Coffin is known to be a man of reliability and the finding of one of these immense bisons, agreeing in size with the above mentioned molar, in association with *Elephas cf. columbi*, conforms with their known occurrence, save for being found at such a high elevation and in local glacial deposits.

So far as the writer is aware this is the first known occurrence of such fossils under these conditions in these mountains, and it brings up some interesting problems which should be studied.

To reach the spot where these fossils were found, one turns off at Cerro, about seventeen miles east of Montrose, on the main highway to Gunnison, and drives twelve miles up from Cerro to the Tripler camp. The Pleistocene fossils were found about one fourth to one half mile above this camp, in the ditch cut.

The Cretaceous fish mentioned are also found near here, in a slide near the nearby Cold Hill camp, in a dark sandy shale and in sandstone.

These localities seem well worth noting for record for the benefit of any specialists who may be interested and have the opportunity to work at this location.

HAROLD J. COOK

COLORADO MUSEUM OF NATURAL HISTORY

ZOOPHARMACOLOGY VERSUS PHYTOPHARMACOLOGY

I HAVE read with great satisfaction the appreciation of my contributions to phytopharmacology expressed by Professor Edwin H. Shaw, Jr., published in the first May number of SCIENCE, page 460; and I was especially interested in the writer's suggestion that

the idea of an antagonism between animals and plants could be extended to the subject of diseases and their treatment. Quoting from Dr. Shaw's communication, we read:

> When we consider the infestations of an animal host with animal parasites, we have a markedly different picture. The host and parasite live together without any marked protective or offensive action on the part of either. When death occurs in these conditions, it is a result of the gradual destructive action of the parasite on some particular tissue of the host. The tapeworm, the liver fluke, the malarial plasmodium, the trypanosome, the filaria worm, the spirochete and the intestinal ameba may be taken as examples of this type of infesting organism. These organisms do not produce any great amount of toxins, and do not stimulate the host to form any great amount of protective substance.

I am writing the present note in order to corroborate with actual experimental data the conclusions he arrived at as a result of his lucid and logical reasoning. During the past year I have been investigating by my special phytopharmacological methods specimens of blood from two kinds of parasitic diseases. In one series of experiments, I have been examining the toxicity for plant protoplasm of blood from cases of malaria. Some of these specimens were obtained in the United States; other specimens, more particularly those from cases of virulent fever, were obtained through the courtesy of Professor R. N. Chopra, of the School of Tropical Medicine, Calcutta. The results of these experiments indicate that, as far as the phytopharmacological tests are concerned, malarial blood contains little or no toxin of any kind. Another series of experiments is at present being carried on by me in collaboration with Dr. O. R. McCoy, of the department of helminthology, Johns Hopkins University School of Hygiene and Public Health, on bloods obtained from dogs infested by the hookworm. These animals exhibit the picture of extreme anemia, and it was deemed desirable to inquire whether this anemia was of a pernicious type. Although these experiments are still in progress, the data already in hand indicate that the blood serum of dogs with hookworm shows no toxicity and behaves exactly like blood from human beings suffering from severe secondary anemias. These lines of investigation give a striking proof of the correctness of Dr. Shaw's reasoning in regard to infestations of an animal host with animal parasites.

DAVID I. MACHT

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THE FIRST ENGLISH POPULARIZER OF SCIENCE

PERHAPS other readers of SCIENCE might be as interested in examining Oliver Goldsmith's "A History of the Earth and Animated Nature" as was the writer, who recently, through Mr. Carter Bishop, of the English department of West Virginia University, was lent an old edition of this work. This particular edition, in two volumes of more than 1,000 large pages, was published in 1853 by A. Fullerton and Company. In this edition, more than fifty years later than the first edition, the editors claim to have corrected many errors of the original work.

In the publishers' advertisement at the beginning of the work they say that Goldsmith is the "first English writer who, by the inimitable graces of his style and manner, threw a charm over the subject which was new to the English reader, and the effect of which, in rendering the science of Natural History popular, has been great and extensive."

Besides the "inimitable graces of his style" the book is illustrated with numerous colored plates, some of which are really good. The classification, though of course antiquated, is in some cases not so much out of date as might be expected of a work written 150 years ago—Goldsmith died in 1774.

In the chapter on "The Crocodile and its Affinities" he mentions the four chief types of modern texts: the crocodile, the alligator, the cayman and the gavial. He tells many interesting things about the various members of the group, some of which details are undoubtedly true, some of which are doubtfully true and some of which—for example, the "open-bellied crocodile" that carries its young in an abdominal pouch—are obviously fiction.

Altogether the book is most interesting, if *not* to be recommended for general consumption by the non-scientific public.

ALBERT M. REESE

WEST VIRGINIA UNIVERSITY

QUOTATIONS

MEDICAL PATENTS

A REPORT has recently been issued by a Committee of the Association of British Chemical Manufacturers (London, November, 1929) suggesting alterations to the Patent Laws in respect of chemical inventions. Many of these suggestions will be welcomed by chemical workers as safeguarding their interests and those of the general public, and as simplifying procedure.

A large proportion of the report, however, is devoted to the question of "medical patents," *i.e.*, the patenting of chemical substances intended for the alleviation and cure of disease, and the committee make

certain recommendations of a revolutionary character to which I will refer again later. At the present time research work is in progress all over the world on the production of synthetic organic substances, often of very complex structure, and demanding the highest degree of chemical skill and knowledge for their production; one has only to recall the past successes of the chemist, such as aspirin, phenacetin, antipirin, novocain, stovain, salvarsan, "germanine," synthetic adrenaline, tryparsamide, and many others, to realize how deeply indebted is the medical profession to the work of the modern organic chemist. In some cases these products have been discovered as the result of researches by individual chemists working in conjunction with a pathologist; in other cases the results have been due to team work in which many chemists have been employed.

An examination of the patent literature indicates that until recently the patentees were predominantly German or Swiss firms, who, by obtaining patent protection for their discoveries, were able to develop them on suitable technical lines, bring them to the notice of the medical profession, and thus cover the heavy expenditure in time and money involved in such work by the sale of the successful patented article. Actually, however, there is no very great profit in such work, as the percentage of "bull's eyes" is very small and often only just enough to help to pay for the expenditure of ammunition involved. In fact, to continue the analogy, such work is rather like firing at a concealed target with a machine-gun; sooner or later an "inner" or a "bull" will be registered, but it necessarily involves a heavy expenditure of ammunition, and a firm or private investigator can afford to continue such investigations only if he is reasonably sure of some measure of protection when he actually succeeds in obtaining a direct hit.

When one considers the untold suffering which has been avoided by the use of, say, the synthetic local anaesthetics such as eucain or novocain, the hundreds of thousands of lives which have been saved by salvarsan (for venereal diseases), by acriflavine (for septic wounds), by germanine and tryparsamide (for sleeping sickness), it will be realized that humanity and the medical profession are under a very great debt to organic chemists. Recently, for instance, in French Congo, a case was quoted of a village of 126 natives of whom 83 were infected with sleeping sickness and doomed to a terrible and lingering death, while others were in a moribund condition: a year later, chiefly as the result of injections of tryparsamide, all these 83 patients were free from infection and fully convalescent.

Research work of this nature should obviously be encouraged in every way, but the report in question proposes a plan calculated to impede and discourage all further independent chemotherapeutic work in this country. It is seriously suggested that it is unethical for a chemist or medical man to receive any reward for his services in this direction, and that, if he is fortunate enough after months or years of work to discover a new curative agent, antiseptic, bactericide, or the like, and applies for patent protection, he shall be forthwith deprived of all his existing legal rights in this, as though he were an outlaw, and these rights shall be handed over to a new government official, the "Medical Patents Trustee," who will arrange for the manufacture of the product, settle terms of royalties, etc. Any such fees or royalties will be retained by the Medical Patents Trustee, who may, in his discretion, repay out-of-pocket expenses in connection with the investigation (and any one who has had to argue costs before a taxing master will realize the hopelessness of obtaining from any bureaucrat a sum anything near the actual cost), and any balance will be devoted to further research. In other words, the unhappy chemist must pay for all unsuccessful research from his own pocket, and when after long and arduous work he attains a successful result his success is to be snatched from him by a medical bureaucrat and devoted to purposes over which he has no control. "Heads I win, tails you lose." In other words, it is perfectly ethical for a chemist to devote his energies to the invention of new steels for armor plates and shells, of new poison gases or of new explosives for the destruction of his fellow men; but as soon as he is so unwise and so unworldly that he prefers to devote his skill towards the alleviation of human suffering, then he is at once to be penalized, and, for all the encouragement given him, he and his family may starve, while the manufacturers and merchants who market the product make their profit and the consultant who enhances his reputation by the successful cures with the new drug may charge whatever fees he feels right.

The whole scheme is fundamentally unjust, illogical, unworkable and contrary to the public interest, as instead of encouraging firms and individuals to carry on research in chemotherapy such work will inevitably slow down and cease except in so far as it may be carried out in government-controlled laboratories. There is, however, a very real danger that the weight of opinion of a vociferous, unenlightened and obscurantist portion of the medical profession may succeed in getting such an ill-advised scheme seriously considered and even smuggled through Parliament, and thereby set back the progress of chemotherapeutic research in this country for decades, while other nations with less distorted views continue to encourage

and assist chemists and medical research workers in their humane endeavors, for in this field no less than in others the laborer is worthy of his hire. No one familiar with the situation in this country in the early days of the war can fail to understand the seriousness of the present attack upon chemotherapeutic research.—Frederick A. Mason, College of Technology, Manchester. *The London Times.*

SOCIETIES AND MEETINGS

THE NORTH CAROLINA ACADEMY OF SCIENCE

THE twenty-ninth annual meeting of the North Carolina Academy of Science was held at Duke University, Durham, on May 9 and 10. Papers were presented before the general section of the academy on Friday morning and afternoon. Following the presentation of papers and the business meeting on Friday afternoon, Duke University served the academy a picnic supper on the new Duke campus. Friday evening the retiring president, Dr. J. B. Derieux, professor of physics at State College, gave his presidential address on "The Corpuscular Theory of Radiation and the Wave Theory of Matter." After this an informal reception was given the academy by Duke University. Saturday morning the academy met in the following sections: General section, chemical section, mathematics section and physics section. Seventy-seven papers and five exhibits were on the program. (Abstracts of most of them and complete papers of several will appear in an early number of the *Journal of the Elisha Mitchell Scientific Society.*)

The executive committee reported the election of thirty-four new members during the year and the reinstatement of four former members. Dr. F. P. Venable, professor of chemistry of the University of North Carolina, was made an honorary life member as a token of appreciation for his services to the academy, to science and to his state. Dr. Venable has been a member of the academy since the year of its origin, 1902, and is this year retiring from active duty after fifty years' service at the University of North Carolina (professor of chemistry, 1880–1900; president, 1900–1914; professor of chemistry, 1914–1930). Two hundred and twenty-eight registered at the meeting.

Mr. Calhoun Pruitt, a student of the Monroe High School, was declared the winner of the High School Science Prize, a silver loving cup, for the best essay presented by a high-school student. Essays for 1930 were confined to the fields of chemistry and physics.

The officers elected for the year 1930–31 were:

GENERAL ACADEMY

President, W. F. Prouty, University of North Carolina.
Vice-president, P. G. Ginnings, Greensboro College.
Secretary and treasurer, H. R. Totten, University of North Carolina.
Executive committee, the above officers and F. A. Wolf, Duke University; Bert Cunningham, Duke University; W. L. Porter, Davidson College.
Representative to the A. A. A. S., W. C. Coker, University of North Carolina.

CHEMICAL SECTION

Chairman, T. A. Bigelow, Duke University.
Vice-chairman, A. J. Wilson, State College.
Secretary-treasurer, H. D. Crawford, University of North Carolina.
Councilor, L. G. Willis, State College.

MATHEMATICS SECTION

Chairman, W. W. Elliott, Duke University.
Secretary, E. L. Mackie, University of North Carolina.

PHYSICS SECTION

Chairman, A. A. Dixon, State College.
Secretary, W. E. Speas, Wake Forest College.

The thirtieth annual meeting of the North Carolina Academy of Science will be held at State College, Raleigh, in the spring of 1930.

H. R. TOTTEN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A BELT PAPER KYMOGRAPH WITH A THREE SPEED GEAR SHIFT

THE recent appearance in SCIENCE[1] of an article describing a commercially built kymograph with a multirange gear shifting device has prompted the writer to describe a kymograph provided with a speed reducer and a gear shifting device which was built by junior and senior college students in mechanical engineering.

For more than a decade the writer has been interested in belt paper kymographs and has frequently studied published diagrams as well as observed those in operation. Therefore, about four years ago when called upon to design an electrically driven belt paper kymograph it was thought best to construct the machine as herein described.

[1] Porter, Roy and Vianey, "An Electric Kymograph," SCIENCE, 71: 41, January 10, 1930.

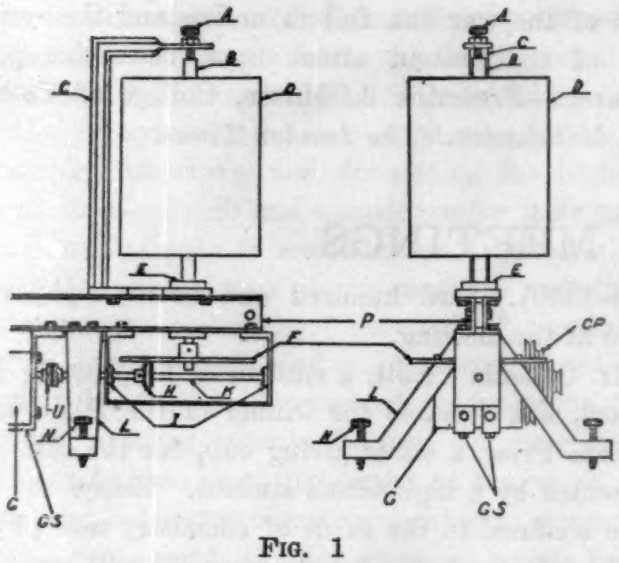

FIG. 1

The frame consisted of two 1 x 2 inch channel irons, Fig. 1, *P*, placed in parallel position and supported by cast-iron legs. To this frame was firmly bolted the head drum bracket, *C*; but the tail drum bracket was arranged so that it could be moved back and forth upon the frame and firmly fixed at any desired position by means of a wing nut. These drum brackets were made sufficiently large that they would accommodate an 8 x 10 drum or two 6 x 6 Harvard drums. The general arrangement of supporting legs, *L*; head drum, *D*; friction drive, *H* and *F*, and the gear box *G* may be noted in Fig. 1, which shows both side and end views of the chief mechanical parts.

The friction drive was chosen because of its simplicity and elasticity. A 7 inch brass disk, Fig. 1, *F*, mounted upon the vertical drum shaft *B* just below the frame is caused to rotate by friction of a leather or fiber wheel *H* which is mounted upon the horizontal power shaft *K*. After learning that the friction disk must be slightly rough and that the leather wheel should be at least two inches in diameter no further trouble was experienced. The power shaft *K* terminates distally in the universal joint *U* by which it is attached to the output shaft of the gear box. As the first kymograph operated satisfactorily still others were made with but slight modifications.

Since these kymographs were driven by a 1/20 h.p. motor operating at 1125 r.p.m., it was necessary to reduce the speed 2,000 times between the motor and the friction drive. In the early model this was accomplished by means of worm gears alone. Learning that the flexibility of the machine was reduced to zero the writer set about to find some type of gearing which would allow rapid changes of speed as well as increase the general flexibility of the machine as a whole. This was accomplished by means of a gear box shown in Fig. 2, which not only contains the reduction gears but also a three speed gear shifting device as well. In Fig. 2, *A* represents a 1–1 set of spiral gears; *C*, a 50–1 worm gear set, and *H* a 20–1

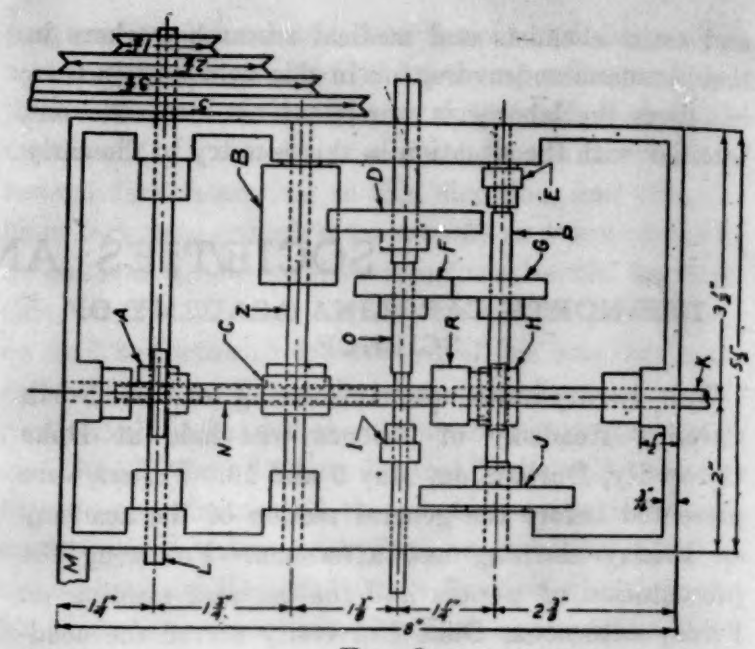

FIG. 2

worm gear set. The various other gears, *B*, *D*, *E*, *F*, *G*, *I* and *J*, are all of 24 pitch, but *B* is only one half the size of *D*, which in turn is four times the size of *E*. *D* has 48 teeth; *F* and *G* both have 20 teeth.

Therefore, as the wheels stand in Fig. 2, intermediate position, the speed reduction is 2,000–1. If pressure were put upon the right end of the movable shaft *O*, the wheels *F* and *G* would be thrown away from each other into a neutral position. Further pressure would cause the wheels *D* and *E* to engage and then the speed would be reduced only 500–1, high speed. On the other hand, if pressure were applied to the left end of shaft *O* the wheels *F* and *G* would be thrown out of contact and into a neutral position, but still further pressure would cause wheels *I* and *J* to mesh and the speed would be reduced 8,000–1, low speed, since *I* and *J* are the reverse of *D* and *E*. The lever for shifting gears and the devices necessary

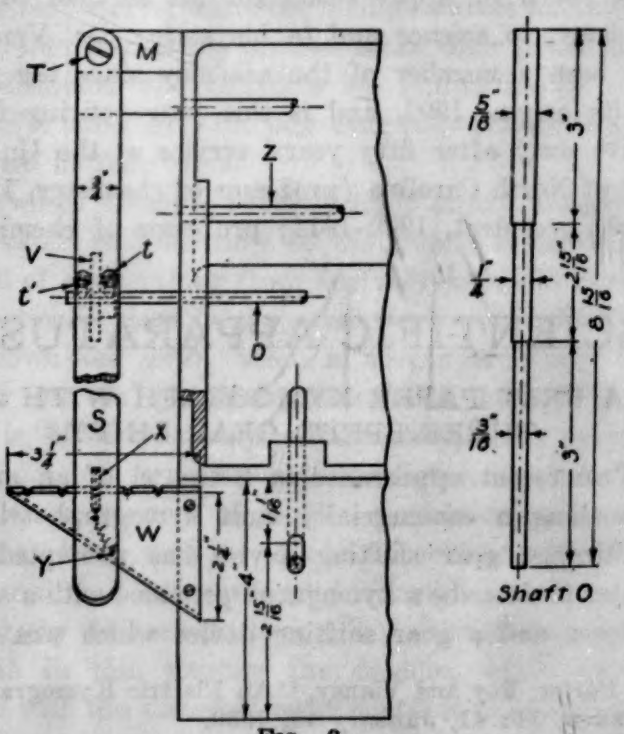

FIG. 3

for retaining the gears in the position desired are shown in Fig. 3. The use of a four stage cone pulley adds further flexibility.

All the gears used, except wheel *B*, may be readily secured from nearly any machinery or model maker's supply house. Wheel *B* has 24 teeth at 24 pitch with ¼ inch hole and 1½ inch face. This wheel was obtained from the Boston Gear Works.

SUMMARY

1. Herein has been described and illustrated a belt paper kymograph, electrically driven, and provided with a three speed gear shift.

2. By the use of this gear shift the operator may instantaneously change the speed of his paper from intermediate to high speed which is four times faster or to low speed which is four times slower.

3. By the arrangement of gears here shown no clutch or clutch lever is needed, and the operator may readily alter the speed by the use of either hand.

4. Although this gear box may appear somewhat complicated and difficult to construct it was built by junior and senior college students in mechanical engineering.

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SPECIAL ARTICLES

SURFACE TENSION BY THE RING METHOD

SINCE surface tension determinations are made frequently by chemists and physicists, and especially by biologists and in the industries, it is important that the quantity measured shall be the surface tension itself and not some other force. Of all the methods which are applied the determination of the pull on a ring is the most often used, as is evidenced by the fact that in one biological laboratory sixty thousand such determinations were made in a period of five years. The wide-spread popularity of this method is probably due to the ease with which a ring of platinum or platinum-iridium may be cleaned, and the resultant rapidity of the measurement, since all that apparently needs to be done is to put the ring in contact with the surface of a liquid, and to determine the force needed to pull it away from the surface.

Although what has been called the "ring method" has been so widely applied, it is a surprising fact that *until four years ago there was no ring method for the measurement of surface tension,* since all that was determined was the pull on the ring, which is related to the surface tension in a way that was before that time unknown. Thus in "International Critical Tables" nine experimental methods for such measurements are listed, but a ring method is not included, since the procedure which had been designated by this term did not supply even one single measured value of surface tension for these tables.

The failure of the ring procedure was due to the fact that the theory had not been developed with sufficient completeness, though an excellent beginning had been made by Cantor,[1] Lohnstein,[2] Lenard,[3] Tichanowsky,[4] MacDougall[5] and others. Since, however, their equations are not extremely simple, and moreover apply only to rings of such dimensions as make them impractical for use, it was customary to neglect their theory, and to calculate the surface tension from the entirely incorrect equation

$$\gamma = \frac{P}{4\pi R} \quad \text{(incorrect)} \qquad (1)$$

in which P is the maximum pull in dynes as determined by a balance, R is the mean radius of the circular ring and γ is the surface tension in dynes per centimeter.

In 1926 Harkins, Young and Cheng[6] demonstrated that a correct value of the surface tension is given by the expression

$$\gamma = \frac{P}{4\pi R} \times F \qquad (2)$$

Since P = Mg, in which M is the mass in grams indicated by the balance, and g is the gravitational acceleration, this may be written

$$\gamma = \frac{Mg}{4\pi R} \times F \qquad (3)$$

That the equation (1) generally used is entirely incorrect and does not give the surface tension at all is shown by the fact that in our experiments the value of the factor by which this must be multiplied to give the surface tension has varied from 0.72 to 1.45, or it exhibits a variation of 100 per cent. The most harmful and absurd fallacy in this connection is the statement which appears so often in connection with this incorrect equation: "It may be true that it does not give the proper absolute values, but of course it gives the correct relative magnitudes." This is entirely untrue,

[1] Cantor, *Wied. Ann.*, 47: 399, 1892.
[2] Lohnstein, *Ann. Physik*, 25: 815, 1908.
[3] Lenard, *ibid.*, 74: 395, 1924.
[4] Tichanowsky, *Physik. Z.*, 25: 300, 1924; 26: 523, 1925.
[5] MacDougall, SCIENCE, 62: 333, 1926.
[6] Harkins, Young and Cheng, SCIENCE, 64: 333, 1926.

since the factor (F) is, as has been stated, highly variable.

The values of F are given in Fig. 1. It may be seen that the value depends on the ratio of the radius

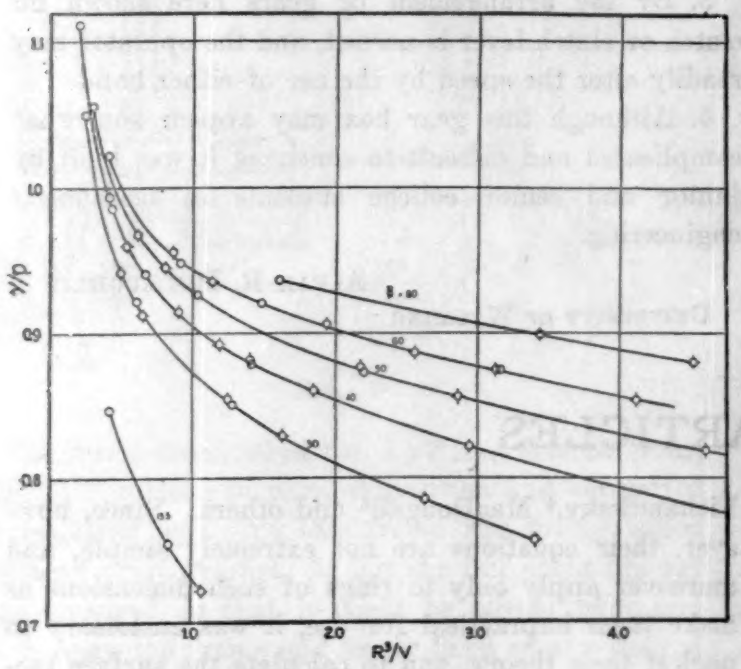

Fig. 1. Correction Factors (F) or $\frac{\gamma}{p}$ for the Ring Method for Surface Tension.

(R) of the ring to that of the circular wire (r) from which it is made, and also on the ratio of the cube of the radius of the ring to the volume of liquid upheld by the ring (R^3/V). This volume is equal to the maximum pull (M) on the ring in grams, divided by the density (D) of the liquid phase, or more exactly to (M/D–d), in which D is the density of the liquid of higher density, and d that of the fluid (liquid or gas) of lower density. The number on the curve gives the value of R/r, and the abscissas the values of R^3/V. Both of these are known in any determination, and the unknown value of F is the proper ordinate. An extensive table of the values is given in the May, 1930, number of the *Journal of the American Chemical Society*, pages 1759 to 1770.

Dorsey[7] has recently suggested that many workers, particularly those who use the du Noüy tensiometer, may be unknowingly measuring the pull of a film of liquid on the ring, rather than the maximum pull (P). The pull on the ring varies with the height (H) of the ring above the plane portion of the surface. For example, ring 10 as used by us has a radius R of 0.6366 cm, while its wire has a radius (r) of 0.01570, so the value of R/r is 40.55. Fig. 2 shows that the maximum pull of 0.5912 grams is attained when the height (H) is 0.302 cm, and that the pull is smaller for either greater or smaller heights. However, it is difficult to increase the height above that for the maximum pull, so what is measured with the ordinary technique is the

[7] Dorsey, Science, 69: 187, 1929.

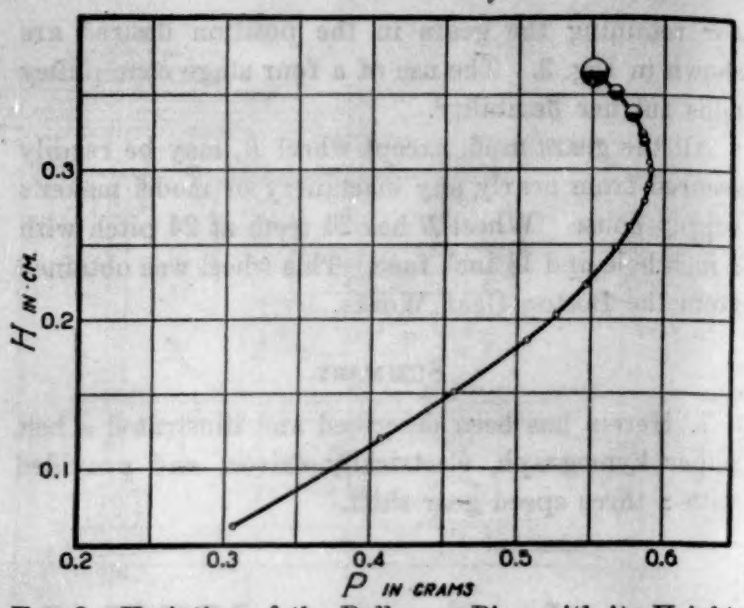

Fig. 2. Variation of the Pull on a Ring with its Height above the Surface of a Liquid.

maximum pull, at least if a chainomatic balance is used for the measurement.

Fig. 3 shows the flask used to contain the liquid whose surface tension is to be measured. The surface

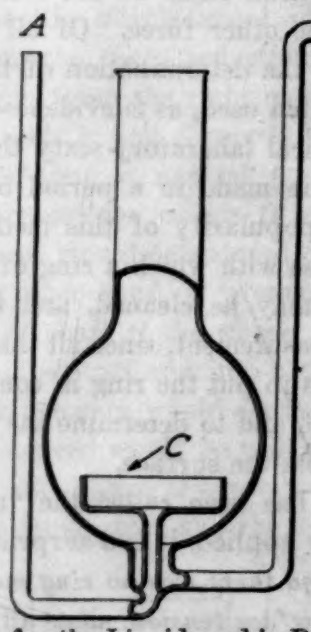

Fig. 3. Flask for the Liquid used in Determining Surface Tension by the Ring Method.

of the liquid is held at C, and the diameter of the surface should be in general 7.5 cm or larger. The use of such small quantities of liquid as to give a much smaller surface invalidates the measurement. Thus the ordinary custom of using small evaporating dishes for this purpose should be discontinued. In order to give a clean surface, the surface is caused to overflow at C before the surface tension is measured. This is particularly important with water.

Fig. 4 gives the apparatus as a whole. The ring is lifted away from the surface by raising the balance by a mechanism which operates so smoothly that it transmits almost no vibration to the beam of the balance. This obviates lowering the vessel that contains the

liquid, which sets up vibrations in the surface, and as a result the ring detaches at a pull less than the maximum.

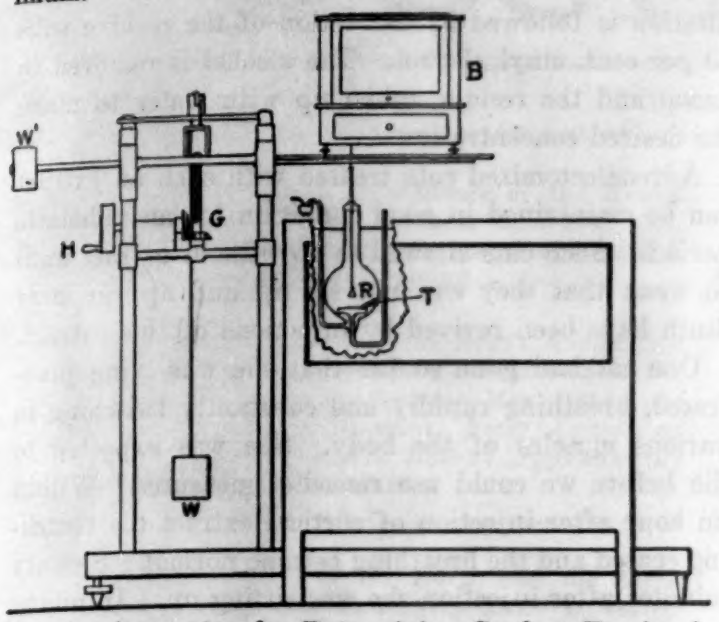

FIG. 4. Apparatus for Determining Surface Tension by the Ring Method.

For accurate work it is important that the ring be kept level. Fig. 5 illustrates the error due to tipping

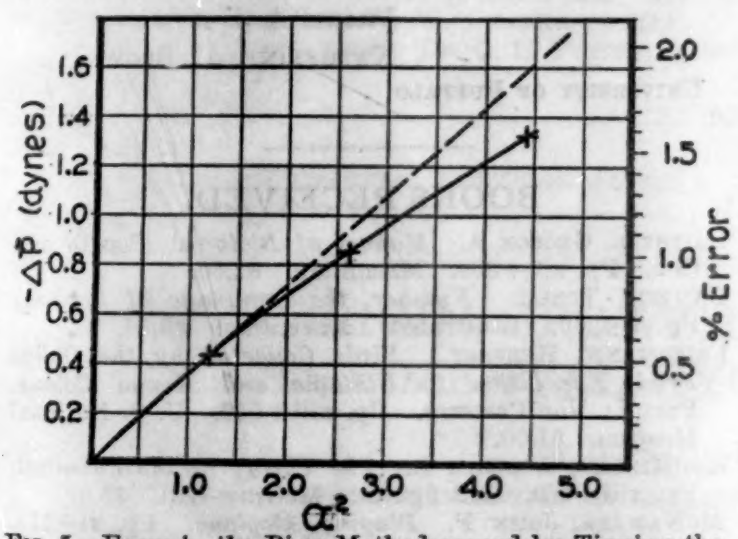

FIG. 5. Error in the Ring Method caused by Tipping the Ring. α^2 is the square of the angle of deviation from the horizontal.

the ring. Here α^2 is the square of the angle of deviation from the horizontal. With an angle of 1 degree the error is approximately half a per cent. This is in marked contrast with the drop weight method for which an angle of 1 degree has no measurable effect, and even an angle of 5 degrees produces an error of only 0.04 per cent.

It should be kept in mind that while the drop weight method is independent of the angle of contact between the liquid and the solid of the tip, provided proper tips are used, the ring method is highly dependent on the angle, and should be used only when it is zero.

The four most widely used methods for the determination of surface tension are: (1) capillary height, (2) drop weight, (3) ring and (4) bubble pressure. Of these the capillary height and drop weight methods are the most accurate, and the bubble pressure method is the least accurate. With pure liquids the methods are accurate under the best condition to the following extent: capillary height, $\pm$ 0.05 per cent.; drop weight, $\pm$0.1 per cent.; ring, $\pm$ 0.25 per cent., and bubble pressure, $\pm$ 1.5 per cent. However, with certain solutions, especially biological liquids, the drop weight method is much more accurate than the determination of the capillary height.

The large error of the bubble pressure method is due to the fact that those who use it most do not determine the maximum pressure, which the theory demands, but only a mean pressure, which is related in an unknown way to the surface tension. Dr. T. F. Young is now engaged in a critical study of the method, and it seems probable that its accuracy will be greatly increased.

Of the four methods only that of the capillary height has been an absolute method. However, Drs. B. B. and H. Z. Freud have recently published a communication[8] in which they present a satisfactory theory, which gives the same results as our experiments. Thus the ring procedure becomes an absolute method for the determination of surface tension. The determination of the bubble pressure would give a third absolute method if the procedure were carried out in a way demanded by the theory, but, unfortunately, most of those who use it do not meet the conditions of the theory.

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HUBERT F. JORDAN

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THE REVIVAL OF COMATOSE ADRENALECTOMIZED CATS WITH AN EXTRACT OF THE SUPRARENAL CORTEX

IN previous brief reports published in this journal[1] the writers described the preparation of an active extract of the suprarenal cortex of beef and its effect upon the life-span of bilaterally adrenalectomized cats. It was demonstrated that extract-treated animals survive in normal health indefinitely and when the extract treatment is discontinued death from adrenal insufficiency results within a short time. To date we have not had an adrenalectomized animal present any symptoms of adrenal insufficiency while receiving treatment. At the end of one hundred days of treatment (an arbitrarily selected period, after which the extract is discontinued) the animals can not be distinguished from normal cats. Mention was also made in the earlier publications of the fact that non-treated adrenalectomized cats showing early

[8] SCIENCE, 71: 345, 1930.
[1] SCIENCE, 71: 321, and 71: 489, 1930.

symptoms of adrenal insufficiency could be returned to normal by administering extract.

Recently we have completed a series of experiments in which the extract was tested on comatose animals prostrate and on the verge of death from adrenal insufficiency. The extract employed is a modification of the one previously described and is very low in adrenalin and solid content.

The cats were bilaterally adrenalectomized and allowed to develop very severe adrenal insufficiency symptoms. At the time of first injection of extract they were prostrate and unable to stand on their feet or move about, and so weak that if placed on their feet they promptly collapsed. The skin was cold and clammy and the rectal temperature down to 95°. The rectal temperature of normal or unilateral operated cats ranges from 101.4 to 102°. Adrenalectomized cats presenting the symptoms just described live but a few hours and death may occur at any moment.

By repeated injections of our purest preparations we have been able to revive such animals and return them to normal condition and to keep them in perfect health by daily injections. The body temperature, blood picture, appetite and strength return to normal.

It is a striking experience to one working with the animals to take a comatose cat with death imminent from adrenal insufficiency and by a few injections to revive it so that within seventy hours it has completely recovered and is running and playing about the laboratory apparently none the worse for its hazardous experience.

Princeton University, and
Biological Laboratory,
Cold Spring Harbor

W. W. Swingle
J. J. Pfiffner

THE HORMONE OF THE ADRENAL CORTEX

In 1927[1] we first published a method for producing an extract of the adrenal cortex which would prolong the lives of totally adrenalectomized cats. Saturation of an acid extract with NaCl forms a precipitate which when dissolved and injected produces this effect. Heating the extract to 80° C. for five minutes destroys the active substance. The addition of ethyl alcohol to make 80 per cent. precipitates the proteins coagulable by heat and nitric acid but does not destroy the hormone.

We have long realized that the method of separating the hormone by salting out is unsatisfactory as a means of concentrating the active substance because with each precipitation so much is lost. We therefore have been working for some time with organic solvents.

The simplest method of preparing a concentrated extract of the hormone is to extract the cortex with ethyl ether. Removal of the ether by vacuum distillation is followed by extraction of the residue with 80 per cent. ethyl alcohol. The alcohol is removed *in vacuo* and the residue taken up with water to make the desired concentration.

Adrenalectomized cats treated with such an extract can be maintained in good condition for an indefinite period. Such cats allowed to go without extract until so weak that they can not sit up and appear near death have been revived by injections of this extract.

One cat had gone so far that she was lying prostrated, breathing rapidly and constantly twitching in various muscles of the body. She was expected to die before we could use remedial measures. Within an hour after injection of cortical extract the twitching ceased and the breathing became normal. Seventy minutes after injection she was sitting up. In ninety minutes she had recovered her strength and was eating.

In 1928[2] we named this hormone cortin. It is the substance essential to life found in the adrenal cortex.

Frank A. Hartman
Katherine A. Brownell
University of Buffalo

[1] F. A. Hartman, C. G. MacArthur and W. E. Hartman, *Proc. Soc. Exper. Biol. and Med.*, 25: 69, 1927.

[2] F. A. Hartman, K. A. Brownell, W. E. Hartman, G. A. Dean and C. G. MacArthur, *Am. Jour. Physiol.*, 86: 353, 1928.

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